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ABSTRACT

The WebNet 2001 conference addressed research, new developments, and experience related to the Internet, intranets, and extranets. The 452 contributions of WebNet 2001 presented in this volume consist of the full and short papers accepted for presentation at the conference. Major topics covered include: commercial, business, professional, and community applications; e-learning/educational applications; electronic publishing and digital libraries; ergonomic, interface, and cognitive issues; general World Wide Web tools and facilities; personal applications and environments; societal issues, including legal, standards, and international issues; and Web technical facilities. (MES)

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WebNet 2001
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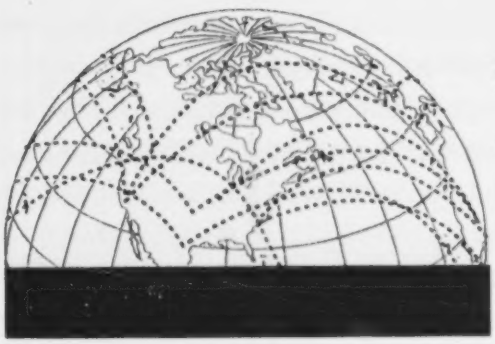

Edited by
Wendy Fowler
Joachim Hasebrook

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Preface

The first WebNet conference of the new millennium is overshadowed by a human and political tragedy beyond imagination. While writing this preface, many of us are experiencing a horrible uncertainty concerning the fate of colleagues, friends, and members of their families. Globalization helped to develop social, cultural, economic and personal relationships. Therefore, not only the USA but also the entire world, which relies on democratic and human rights, has been hit and deeply hurt by the terrorists' acts of the 11th of September 2001. We are mourning with the victims and their relatives, and we are convinced that justice and freedom will prevail.

The Program Committee and AACE believe that we need more global development and less isolation and marginalization. The WebNet conference as a global conference on the "networked world" can be one small contribution to a sustainable growth that decreases the so-called 'digital divide.' In this spirit, it is our pleasure to present to you the Proceedings of the Sixth WebNet Conference – WebNet 2001. This conference addresses research, new developments, and experience related to the Internet, Intranets, and Extranets.

The 452 contributions of WebNet 2001 presented in this volume were submitted from 51 countries. The volume consists of the Full and Short Papers accepted for presentation at the conference from a collection of 834. All submissions were carefully reviewed by at least three members of the Program Committee and their recommendations used for selection. Borderline cases were reviewed at a special Program Committee meeting where appropriate decisions were made based on re-reviews.

Of the accepted contributions, five were considered outstanding based on the reviewer's scores and comments. The outstanding papers represent the top 1% of accepted papers. These papers are indicated in the conference Final Program. Authors of outstanding papers have been invited to submit extended versions of their papers to the *WebNet Journal* (**www.aace.org/pubs/webnet**).

The coverage of the contributions is wide and gives the attendees of the conference the opportunity to learn more about innovative technological developments and practical experiences in many application areas. This is one of the features that distinguishes the WebNet series of conferences from others that focus on more specific areas. Our intention has been to provide a meeting place of developers, researchers, practitioners, and users as a forum wherein persons from disparate but related fields can meet and learn about new developments that impact their professional lives.

The major areas covered at the conference and presented in this volume include:

- Commercial, Business, Professional, and Community Applications
- E-Learning/Educational Applications
- Electronic Publishing and Digital Libraries

- Ergonomic, Interface, and Cognitive Issues
- General Web Tools and Facilities
- Personal Applications and Environments
- Societal Issues, including Legal, Standards, and International Issues
- Web Technical Facilities.

These general areas have been divided into several more specialized topics.

In addition to the papers included in this volume, participants at the Conference heard leading experts present Keynote and Invited talks; participated in tutorials, workshops, small-group discussions, and poster sessions; and had a chance to see demonstrations of various items of interest. The Conference was preceded by two days of tutorials and workshops, which conveyed the depth and breadth of the conference.

Please plan to attend the next conference in Toronto, Canada, October 14-19. To be present and observe the WebNet series is one of the best ways to stay current with the rapid and intriguing developments of the Web. Periodically check the conference website at **www.aace.org/conf** for information

Last but not least, we would like to thank all authors for submitting their work, and all members of the Program Committee, listed on the following page, for their cooperation and time spent reviewing submissions. Special appreciation is extended to Gary Marks (AACE), who is one of the main driving forces behind this volume as well as the WebNet series of conferences, and the AACE staff who contributed so much to the success of the conference.

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The Mentor Project: Designing the next generation of instructional software

Terence Ahern, Texas Tech University, USA; David Dean, Texas Tech University, USA; Roman Taraban, Texas Tech University, USA

The Internet is a wonderful source of information. Information, however, is not instruction. The problem for teachers is not simply access. In order for teachers to weave this content into meaningful lessons.it is necessary for content producers to categorize information into meaningful structures. The solution is multi-faceted. One the one hand content producers need to be able to classify their content in such a way that it makes sense to teachers. One the other hand teachers need a way of structuring lessons in such a way so that they easily used and shared among teachers. The Mentor Project is a follow up to a paper presented at WebNet 2000 which outlined this work in progress. This paper is a report on development of the overall project and the software in particular.

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Interactional conflicts among audience, purpose, and content

Jacqui Cyrus, Texas Tech University, USA; Terence Ahern, Texas Tech University, USA

We studied the effect electronic forms of writing, especially collaborative environments such as email and threaded discussions, had on the development of students formal writing skills. Implications for curricular design will be discussed.

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A Web-Based Introduction to Programming Course

Leandro Amaral, Federal University of Goiás, Brasil ; Eduardo Albuquerque, Federal University of Goiás, Brazil

Programming is still a myth for many people. Many people think that programming is a very difficult activity and do not want to start learning it just because of rumors they hear. This project aims at the development of a Web-Based course named "IPL – Introduction to Programming Logic", whose objective is to naturally make students familiar with programming logic, by indexing their inherent logic thinking to the one they will be introduced to.

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An Assessment Model for Distance Education Courses

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We present a model for assessment to be used in web based distance courses at UFGVirtual in Brazil. UFGVirtual is a project at Federal University of Goiás - Brazil that aims at developing and distributing non presencial courses based in the web. Although some courses are already being delivered there has been a need to develop more effective ways to assess student's performance, the main goal of this project.

Using User Profiles to Customize Assessment in Distance Education

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Abstract This work is part of EDUCAR project. We are studying how we can define and use user profiles to offer tailored interface and to customize content according to performance and interest of students. We also plan to provide instructors with information to adapt and define versions of documents suitable to the different profiles.

Acknolegements: Project partially supported by CNPq/RNP/PROTEM REMAV, grant 181201/98-4 (NV).

Introduction

The main objective of EDUCAR project is to create a model for developing and managing Web based courses. The project defines resources for course authoring, keeping track of students progress and assessment. The process of keeping track of the student progress can be made easier if we group students according to common characteristics. E can also use group information to customize assessment tests. We propose the definition of user profiles, that can be obtained automatically.

EDUCAR project is being developed within Federal University of Goiás (Brazil) which is in the beginning of an effort to create a Virtual University. At the moment two courses are already implanted: one for teaching mathematics to high school teachers in public schools and the second is an archeology course. The profiles are going to be tested using these two courses.

Project guidelines

One of the main points in succeeding in any web based project is having an attractive interface. We also think that it should be able to customize the look and feel of the interface (to a certain extent, of course) [SUDARSKY, 1989]

A second point of interest when we make information available to large groups is to control access to the documents. We sometimes have to restrict access to some parts of the content. We should be capable of hiding information without making it obvious for the user that his moves are being restricted. We will be using information gathered from user interaction, his status in the system, defined by his enrolment in the course to dynamically create tailored pages.

Not all information is dynamically obtained. The enrolment process defines the level of access allowed. For example, in our mathematics course, the target population is composed of teachers in public schools. We also plan to make the courses available to all students, including the teacher's own students. In that case, the teachers will have access to some support material, solved exercises that will not be available to the whole group of users.

In the process of creating user profiles, the key point is user identification. The first step is user enrolment in the system. The user is given a password and identification that will be used to keep track of his activities.

The system makes distinction among students, teacher-student and teacher-author. The first is a regular student, the second one is a teacher in a recycling program or needs needs

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material to use in his classes and the third one is the teacher responsible for the authoring of the document.

To define the profiles, we keep track of pages visited by each student, time spent in each page, level of details required. The level of details is obtained from the number of available links followed. The information obtained is can also be made available to the students who can then identify his strongest and weakest points.

The use of profiles is still very dependent on the authoring process. The author must rate links according to course objective. Some links, for instance can be rated "must be followed" if it contains basic material. In particular, the authors are being required to define links for students with special needs. Some of those links a hidden from more advanced users, although those defined as teacher-student can choose to have all references available if he is enrolled mainly to gather information to improve his classes.

We are also implementing "grading buttons" that allow users to give grades to certain links. This information is also gathered and used to customize pages to other users identified with similar profiles.

Assessment is another point of interest. Tests can also be defined taking into account user profiles. Slow learner are provided with test more frequently and with rising level of difficulty.

All information gathered by the system is stored in a database [CERQUEIRA, 1999] Statistics on users behavior, links followed, grades given to links, navigation order and pages visited are provided to the author so he can improve his course.

Conclusion

Awareness of user diversity is very important to guaranty effectiveness of instruction material when teacher do not have "eye contact" with students. We must provide an easy o use interface and content in a way that respects students rhythm and time available for studies. A course model must no be a barrier for the student. The main objective of any web based course is not teaching how to use the system but to transmit the intended content. We have found that a large amount of information available can take the focus out of the main object of the course. However, it is very difficult for any author to define how much is too much.

We are still implementing the system so we do not have empirical results to assess the effectiveness of our proposition. However we believe that our project can contribute to the development of better courses, more attractive material, and to make authoring process less empirical than it is today

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Technology integration and classroom dynamics

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Abstract: An examination of student attitude towards technology revealed students prefered using technologies that made learning "interesting". Need, access and transferability of technology were major considerations in students' preference for some technology. The Internet is a tool preferred by students to other technologies. The Internet's ability to provide information and make learning "interesting" played a major role in the students' decision. The widespread use of the Internet influenced classroom activities, with students taking more active role, and learning and teaching styles displaying increased student-centered learning approach. For this report, students and an instructor were interviewed, while participant observation was conducted at an instructional lab where undergraduate students were taking a course on technology integration in education.

Introduction

Technology use in educational institutions is a focal issue in learning improvement activities and efforts. Technological advancements and re-evaluation of instructional strategies and curriculum widely contributed to the incorporation of technology. In today's classrooms, technology is perceived to be providing more opportunities to students in their learning. It has changed the teaching and learning strategies. Technology in classrooms provides students with access to materials, overcomes barriers (age, gender and color) in classrooms, and gives learners different styles in classroom learning. Despite these perceived benefits provided by technology in classrooms, it is just a tool (Hyjek, et. al. 1998).

An important technology at the center of this move is the Internet. The use of the Internet as an instructional aid has increased over time in the traditional classroom. Kumani (1999, in Kelch & Karr-kidwell, 2000) asserts the Internet has affected instructional delivery systems in institutions of higher learning. Faculty changed their courses from traditional to web-based while others use the Internet as part of instruction in traditional classrooms. The Internet will have a major impact on learning in this century. However, focusing on the Internet only as an alternative delivery system can create discrepancy in students learning because of costs, experience and attitude towards the Internet. Selection of other alternatives should be based on their ability to generate interactivity as the key is learner-centered learning (Forsyth, 1998, Johnson, 1997).

Despite all the misgivings about technology use in classrooms, it is increasingly incorporated in classrooms, and will undoubtedly become part and parcel of the teaching and learning process. As can be seen from the current trend of integrating information technology in instruction, "the text as the university educator professor knows it might soon cease to exist. It appears unlikely that the pencil and textbook tradition of yesterday's classroom will continue to hold such a dominant position in American education" (Burow-flake, et. al., 2000, p. 72).

If technology is not appropriately used, it can compromise the quality of student education. Technology should be introduced if it is suitable and if users are interested. This study was an investigation of students' perception of various technologies. As a major technology increasingly used for instruction, the influences of the Internet was examined.

Method

The study explored technology integration in instructional activities. An examination of technology use in teaching and learning, notably the Internet, was conducted on a *Technology application in education* course at a university. Attention was paid to the attitude of students towards different technologies, and learning activities and Internet use by students. Comprising students of all majors and undergraduate rank in a mid-western education college, the course was about teaching pre-service teachers how to integrate technology in their disciplines. Participants in the study included all 22 students (14 females and 8 males) and the instructor. The study was conducted in an instructional lab that had the following technologies: 26 PCs, a scanner (image and OCR), two HP networked printers, cobr printer, an LCD projector, and a large projection screen. The computers had Internet connection, speakers and microphones, and various educational application programs such as Word, Access, Excel, PowerPoint, HyperStudio, ClarisWorks, and KidPix.

Data collection techniques included 5 hour-long taped personal interviews with students. Experience in technology and activities in class determined selection of interviewees. Survey questions were distributed to students during the last week of class. The students were requested to place their responses in the instructor's mailbox at the department's office, 16 of which did. The instructor was a key informant. A one-hour in-depth interview with the instructor shed more light on students' attitude towards various technologies, roles of the teacher and the learner, teaching styles, and students learning. Information collected through interviews was triangulated with records of observations made as a participant in classroom activities. Each classroom meeting was observed which was twice a week. As *CourseInfo* web delivery program was used to supplement face-to-face instructional activities, students' online activities were also observed. Data collection and analysis were conducted concurrently (Marshall & Rosmann, 1999) to help draw conclusions from organized data.

Findings, summary and conclusion

There was a general consensus among students and the instructor that technology in general and the Internet in particular had influenced classroom activities. This included teaching and learning styles, students' attitude, instructional roles and classroom management. Students had displayed little enthusiasm for programs that had limited features such as audio, video or animations. Of

the application programs, students spent more time using PowerPoint and HyperStudio than working on their spreadsheet and/or database projects. One student stated that the former were fun to work with and that accounted for many students' preference.

Need, access and transferability of technology was an important consideration in students' choice or preference for some technology. Students displayed interests in learning about technologies they used, or were easily transferable to their immediate or future needs. The teacher corroborated students' views that access to technology outside the classroom influenced students' attitude. For instance, some students were reluctant to use software that was not commonly used elsewhere. Some learned more about printers as they could apply skills gained to work on their printers at home.

The students and the instructor stated that while it is good to use application programs and the Internet together, they gave leverage to the Internet because more could be done with the Internet. Students cited communication, information, and entertainment features that the Internet provides as motivating factors for Internet preference. While not overly favoring the Internet, the instructor added the Internet could be used for instructional activities both within and outside the class. The fun part about software was similar in hardware. When using the various hardware facilities, students were excited about digital cameras and scanners. They used these peripherals to take pictures of themselves and other events for posting on the web. They were more interested in learning about a digital camera than a motherboard. For instance, when teaching about the computer motherboard and other peripherals like printers and zip drives, less than half of the students showed any interest.

Students found in the Internet easy access to multiple sources of current and inaccessible information using multiple means of delivery like text, video and audio. The Internet reduced dependency on the instructor as students found in it supplemental or alternative information to the instructor's. Some students displayed positive attitude towards learning as the Internet combined visual and audio features with the text and the teacher's talk. Meanwhile, the Internet can be detrimental to students' learning if used inappropriately. The study discovered the Internet made classroom management difficult. The teacher became handicapped, with limited roles and responsibilities. Students engaged in different activities, not paying much attention to the lesson or the teacher. The teacher found it difficult to "police students' activities". According to the teacher, students' limited Internet skills diminished efficient use of Internet resources. Students spent considerable time on the Internet that could have been used for other learning activities. Students had developed dependency, preferring to use the Internet to other sources like textbooks. The teacher was concerned students referred to the Internet quite often. On the other hand, the instructor admitted the increasing confidence shown in the Internet had cast doubt on his professional competency even if students did not intentionally do that.

Technology is increasingly used for instruction. Educational institutions implemented use of technology in classrooms. Students and teachers prefer some technologies to others. Of the technologies used, the Internet has become one of the preferred and widely used tools for improving the quality of education. Whether integrated in a web-based or face-to-face learning environment, many people agree the Internet can improve learning. This potential can be tapped if the Internet is incorporated appropriately. The Internet should be used only when it is suitable and even then applied together with other tools. Students should be given training in Internet use while proper and clear guidelines should be established. And the fun part of learning should be reassessed so that learning involves more seriousness and challenges.

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Tools for Tracking Employees' Usage of Internet

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Abstract: The rapid development and deployment of Internet technologies has changed the daily operation of many businesses. Although the Internet is considered a powerful business tool, with its use increasing all the time, you may still find, however, negative aspects linked to its usage in various areas. Reports, so often, maybe found in the computing press of how the Internet is being misused by employees. This paper suggests and puts forward the need for corporate Internet connections to be monitored along with the creation and evaluation of tools to aid the monitoring process.

Introduction

It was stated [1] that more than eight million person-hours of productivity are lost to UK industry each year because of employees surfing the Internet. If an organization is to control its network and computer systems it must put, in place, policies that must be agreed upon by the board of directors and distributed to all staff.

If a policy is not in place in your organization already then the JANET acceptable user policy [2] is arguably the most appropriate. Not only does it cover illegal aspects of Internet use, but also usage that cause annoyance and inconvenience to valid users. It is recommended that there are five points to consider when writing a policy [3].

Proxy logging of Internet usage to a log file may give a small degradation in network performance. This small degradation in performance will be, in most cases, dwarfed by the performance degradation due to policy violation. The proxy server log file lists every web page request made by a users web browser to the Internet, listing the IP (Internet Protocol) address of the requesting computer and the Universal Resource Locator (URL) requested. It should be noted that the proxy log files could grow to unmanageable sizes with in short spaces of time.

It is stated [4] "Procedures for monitoring use of information processing facilities should be established. Such procedures are necessary to ensure that users are only performing activities that have been explicitly authorized". This quote stands to reaffirm the need for monitoring of system usage.

Log files are very important in the monitoring of networks and systems [5]. "On the Internet, however, you have neither a physical description nor fingerprints. Therefore, without logs, making a case is almost impossible".

Commercial Products

Aiding in Proxy log files analysis, many commercially available tools are investigated. These are ranging from freeware products, such as Cache-Stats, to those priced in thousands of pounds. Three products are examined and looked at: Cache-Stats, NetTracker and Cyfin Reporter Pro. Below is a table of various products' features being compared.

	LogLook	Cache-Stats	NetTracker	Cyfin
Cost	*N/A*	*Free*	*$995*	*$1,499*
Pre-defined reports	*Yes*	*Yes*	*Yes*	*Yes*
Custom Reports	*Yes*	*No*	*No*	*No*
Data Analysis	*Yes*	*No*	*Yes*	*No*
Policy awareness	*Yes*	*No*	*No*	*Yes*
Data classification	*No*	*No*	*No*	*Yes*

Table 1 Comparison of Features

System Overview

A list of design criteria and features, based on investigated products, was set out to enable the design and implementation of a customized tool, tailored for corporate use. The desired features are:

- Name lookup (it is more readable if a domain name lookup is performed).
- Schedulable (the ability to run portions of the program, such as name look up and basic summaries at non-peak times).
- The ability to categorize sites into different groups.
- The ability to open any web page reported into a browser.
- Reports per user and per site.
- The ability to analyze any data represented, preferably by clicking on the data with the mouse.
- Highlighting of possible policy violation.

The system, called LogLook, will be constructed of three separate parts; the log file pre-processor, the automatic report generator and an interactive application to aid the System Manager in the examination of log files. Using this three part modular approach will help in the maintenance of the product throughout its life.

The system will be implemented using a database engine to handle the bulk of the processing. The pre-processor will prepare the data from the log file and then load it into the database. Script files that query the database and report the results via email to the System Manager will generate automated reports. The interactive application will be implemented using a web server. A set of HTML pages will be created to enable the user to query the database. Returning reports will produce HTML pages dynamically to enable the user to view results through their web browser.

Conclusions & Future Development

The analysis tool was put to good use and, within a week, it has been discovered that a large proportion of traffic was non-work related, although it was clear that none of the traffic was illegal or illicit, but mostly made up from soccer news, stock market dealing, looking for new jobs, booking holidays, reading online news papers and many other ordinary sites. Due to commercial senstivity, data cannot be presented in this paper.

Included in the logfile table is data that is not currently used. It is hoped to take advantage of this data in the near future. The data not yet used holds information on the time taken for each download and the number of bytes downloaded. The inclusion of reports that deal with the time spent downloading and the quantity of data downloaded would be useful enhancements to the system.

It was decided to use a database, since large amounts of text data are processed. The decision was to use mSQL [6]. It uses standard SQL for its data manipulation and offers many interfaces to different languages (including C, Perl, Java and Tcl), but the interface to the data , decided upon , was via HTML, using W3-mSQL. mSQL's scripting language, called *lite*, provided utilities to perform DNS name look up.

The next step of this project is to re-design it in PHP [7] and MySQL [8]. This would have several benefits: firstly, PHP and MySQL are free to use for commercial projects, where Hughes Software's miniSQL is only free to education. Secondly, is to enhance performance. MySQL server is now faster than miniSQL on data transactions and data processing.

PHP offers many more features than miniSQL's lite programming language, PHP also has an additional performance increase when it is implemented as an Apache server module. Apache modules are executed much faster than CGI scripts because the server does not have to make an operating system request to spawn a shell to run the CGI program or script in, instead the server just forks a process. PHP also has many features which could be used for the pre-processing of the data ready for uploading. PHP scripts can be run from the command line as well as through a web server.

Another feature of PHP, we hope to use, is its ability to produce simple images (gif or jpeg) which could be used to produce a graphical representation of the data which, in turns, should make it easier to get a quick overview of results.

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Virtual Private Network Support in a Corporate Network

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Abstract: This paper presents a case study, whereby a large organisation; Sheffield Hallam University (SHU) has considered improving the security of its current corporate network. A model has, already, been built for Sheffield Hallam University's infrastructure network. A scheme is progressing to set up, analyse and test all possible ways of securing information between various end-points of the network.

Introduction

In the process of supporting a proper network security solution, we need to consider and evaluate a number of IPSec-certified products (recent list of IPSec-certified VPN gateways is provided by the ICSA Labs [1] along with a set of criteria for products evaluation [2]) . Other industrial products, which are not mentioned in [1] but are still certified by ISCA include; Cisco's PIX Firewalls (IPSec-support provided) [3], Novell Border Manager [4] and a few others. A number of testing models, to support virtual private network in a corporate network, are being proposed in the following sections.

Novell Border Manager

Novell BorderManager [4] is aimed towards providing users with better security and management on the borders between traditional proprietary networks and the Internet. The suite of integrated components includes; advanced firewall security, authentication and virtual private networking capabilities for the encryption of data and tunneling.

Sheffield Hallam University has a large Novell implementation. It supports a very large Novell NDS network with Novell 5 Servers and NT clients running ZEN, directory-enabled desktop management solution by Novell. That is one reason, perhaps, inclined towards using Novell products. A Cisco 2600 series router [3] will be added on the boundary of the network, effectively forming the border of the network itself.

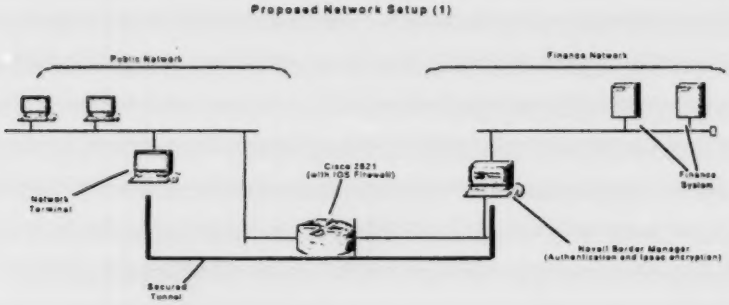

Fig. 1 Proposed Network Setup 1

Fig.1 above shows the network setup with a 2621 router placed before the BorderManager, which acts as a VPN Gateway, providing IPSec encryption and user authentication. The Cisco 2621 router, being used, will have a Cisco IOS Firewall. It enhances the existing Cisco IOS security capabilities making it a complete network security solution from an ordinary router. It provides firewall, intrusion detection, authentication and encryption services. It incorporates some advanced security features, such as stateful application-based filtering (context-based access control), defending against network attacks, authentication and authorization of users and real-time alerting.

Windows 2000

An alternative to BorderManager model will be Windows 2000 (see Fig. 2). It is highly recommended as Windows 2000 is understood to be the next major network operating system planned for implementation across the academic communities in general. The enhanced security features, promised by Microsoft, for Windows 2000 need to be investigated. Windows 2000 will act as a VPN Gateway, providing IPSec encryption and user authentication. The network setup below demonstrates the use of Windows 2000

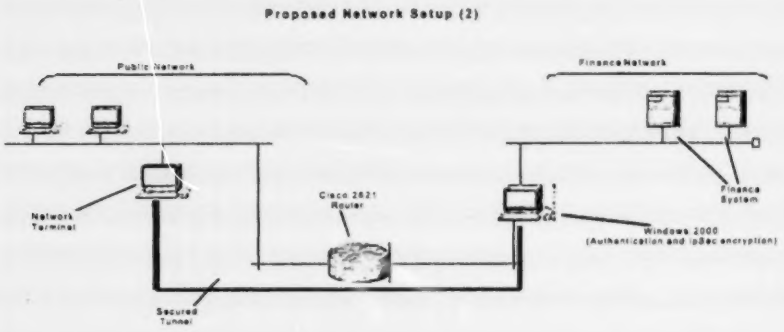

Fig. 2 Proposed Network Setup 2

Cisco 2621 Router

One of the advantages of using the Cisco 2621 router along with its IOS Firewall features, is that it provides a single box solution not only for the firewall but also for the IPSec VPN encryption and authentication (see Fig. 3). One of the major concerns here is that if all the security services are off-loaded onto one box, then that will create a single-point-of-failure. This situation is not acceptable, however, unless a standby pre-configured router is available, which takes over in case of the router failure. Considering the complexity of the router configuration (security settings and encryption particularities), it is highly unlikely that such an arrangement would be preferred. Such a setup would be still tested, however, in order to check for performance variation from other network set-ups and the ease of management of the network; i.e. managing a single device rather than a firewall and a gateway separately. The network setup shows the router simply positioned between the two networks, promising to provide complete security services.

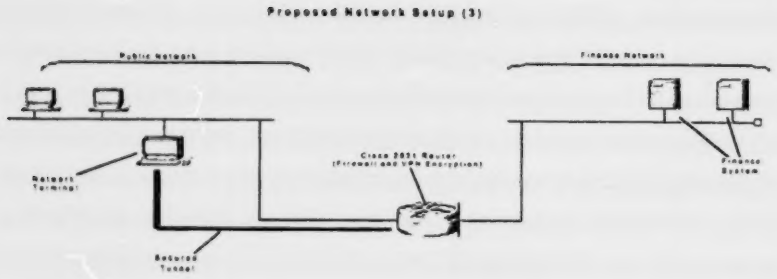

Fig. 3 Proposed Network Setup 3

Future Work

Work is underway to set up, analyse and test all possible methods (mentioned in previous sections) for tunneling and securing information between various end-points within the network . Management and distribution of Public Keys (Public Key infrastructure - PKI) is part of the investigation as well .

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Conctructivist vs. Objectivist Approaches to Teaching On-Line

By Kay W. Allen

The long-term debate over the most effective way to teach has only been intensified with the introduction of distance education. Whereas the remainder of this paper and beyond could be used to address the many pedagogical/androgogical issues associated with on-line learning, the discussion will be limited to briefly reviewing the constructive approach, also known as discovery learning, and the expository style of teaching. One issue in the whole debate is whether a constructivist or discovery approach, as opposed to an objectivists or expository approach, is the better method to be used to enhance learning, specifically retention and transfer.

For some time, there has been agreement among educators that there are four broad dimensions to be considered when planning instruction. The four dimensions are:

- Student – human development, individual differences, learning styles, motivation, etc.
- Teacher – self knowledge
- Content or subject knowledge
- Pedagogy/Andragogy (See below for further explanations of these terms.)

When one is considering distance education, there is a fifth dimension to be reckoned with. The fifth dimension is the method of delivery, the medium, the whole new environment created by the fact that the instruction will be via some form of technology. The possibility of directly transferring course content and teaching strategies as they exist in a face-to-face class situation into a distance format is not only clumsy but also ineffective.

The scope of this paper will be to review existing concepts related to learning and attempt to construct a bridge from what is believed about face-to-face instruction to learning via a distance education format. The available research on teaching approaches in the distance education environment is rather sparse when it comes to evaluating learning outcomes. By far, the existing body of literature is focused on student reported outcomes, primarily the student's satisfaction with and willingness to repeat an on-line course.

Currently, based on data collected by on-line learners, the belief is that students enroll in distance education courses because of convenience, not because they believe they will actually learn more or even as well as in a face-to-face educational setting. While they are motivated to enroll in an online class, their reasons are usually driven by "I don't have attend class, so I'll have more free time" and "It will be easier" (Personal communication from Charles Dziuban, University of Central Florida).

Pedagogy: The term pedagogy has been associated with teaching children. However, the concept is applicable to any teaching situation. Where content is the "what," pedagogy is the "how" – how the content is taught. One can think of pedagogy as the link between what the teacher wants students to learn and students' actual learning. The specific strategies for teaching a particular subject matter is pedagogy.

Andragogy: The term andragogy is, simplisitically, pedagogy in learning situations where the learner is an adult.

Constructivism:
Theorists writing in the emerging constructivist tradition often contrast their ideas with the epistemological assumptions of the objectivist tradition. Objectivism is the view that knowledge of the world comes about through an individual's experience of it. As this experience grows broader and deeper, knowledge is represented in the individual's mind as an ever-closer approximation of how the world really is. Knowledge is thought to exist independently of learners. Learning consists of transferring that knowledge from outside to within the learner. Constructivist "theory" rests on the assumption that knowledge is constructed by learners as they attempt to make sense of their experiences. Learners, therefore, are not empty vessels waiting to be filled, but rather active organisms seeing meaning. Learners use constructive processes to form, elaborate, and evaluate competing mental structures until a satisfactory one emerges.

The Rhizome, a root like stem, is often used as a metaphor for understanding the constructivists philosophy of learning. This rhizome metaphor likens learning to a mass of roots, a tangle of tubers with no apparent beginning or end. It constantly changes shape and every point in it appears to be connected with every other point. Break the rhizome at any point and the only effect is that new connections will be grown. This metaphor lies at the heart of the semiotic conception of cognition.

Jerome Bruner is one of the learning/instructional theorists who support the philosophy of constructivism as the foundation for understanding how learning occurs and how instruction should be design and delivered. Bruner, who used the term "discovery learning" (1961) defined discovery as learning in which the learner constructs meaning from new situations. Bruner (1971) defined learning as a process in which learners construct new information based on their existing knowledge. In this constructing process, learners fit new material into their personal system of associations and categories already created. He theorized that when learners build knowledge themselves through discovery it aids in retention. Bruner (1961) strongly advocated the discovery method as stated here:

> I would urge now in the spirit of an hypothesis that emphasis upon discovery in learning has precisely the effect upon the learner of leading him to be a constructionist, to organize what he is encountering in a manner not only designed to discover regularity and relatedness, but also to avoid the kind of information drift that fails to keep account of the uses to which information might have to be put. Material that is organized in terms of a person's own interests and cognitive structures is material that has the best chance of being accessible in memory. That is to say, it is more likely to be placed along routes that are connected to one's own ways of intellectual travel (pp. 26-32).

Bruner (1971) advocated that learners become good problem solvers in order to give some assurance that they will be able to apply the material they have learned in an educational arena to a variety of situations. He believed that an important part of teaching should be to arrange educational environments that will "optimize learning according to various criteria - to optimize transfer or retrievability of information" (Bruner, 1966, p. 165). He insisted that the goal of education is to give students enough tools to function in the world and therefore students need to be able to make sense of the world in their own fashion. He said, "Our aim as teachers is to give our students as firm a grasp of a subject as we can, and to make as autonomous and self-propelled a thinker as we can - one who will go along on his own after formal schooling has ended" (Bruner, 1961, p. 23).

Objectivism:

The more traditional expository teaching approach is based in the objectivists paradigm. The expository approach is the traditional method used in schools and can be defined as an approach to instruction wherein learners receive, in final form, the content of what is to be learned so that it can be readily assimilated.

From the perspective of the objectivist, the world is structured and that structure can be modeled and mapped onto the learner. The goal of the learner is to "mirror" reality as interpreted by the instructor. Knowledge is external to the knower and so can be transferred from one person to another. The learner's role is to remember and reproduce the knowledge that is transmitted by the teacher or professor. This may be manifested by the "sponge method" of instruction.

Not all researchers feel that a constructivist or discovery approach is the best approach and argue for the more traditional expository approach to instruction. Ausubel and Robinson (1969) argue that although transfer and problem solving are indeed admirable educational objectives, that they should not be the major function of the school. Acquiring subject matter content should be the major goal of education with problem solving supporting this goal.

Immediate Recall.

There is evidence to advocate the use of the expository method of instruction for the purpose of immediate recall. Rowell, Simon, and Wiseman (1969), compared the expository method of learning with that of discovery. They first created a learning task that was equally unfamiliar to the subjects. Their subjects were post-graduate, full-time students at the Department of Education of the University of Adelaide. Both methods of learning were employed for

the same duration. The participants were given unfamiliar symbols akin to hieroglyphics to learn. These symbols could be combined together to form other meaningful symbols.

All participants were given a test immediately after the learning period. The researchers found significant differences in favor of the expository method. They concluded from their study that the expository method of instruction has greater pedagogic merit. According to the interpretation of the researchers, within the framework of Bruner's view of knowledge construction subjects in the expository group "acquired a better organized and more comprehensive schema than did discovery subjects" (Rowell et al., 1969, p. 242). However, they hypothesized that the results from their study may have been biased either by the fact that their participants were well versed in the method of expository learning from having learned by this method throughout their lives or that the time limit imposed on the discovery learners impeded them from adequately creating ways to assimilate new information. These factors, they conclude, may have given the expository learners an edge in immediate recall.

Haselrud and Meyers (1958) found similar results in their study with codes. Their subjects had better results on immediate recall when the expository method was used as compared against a discovery method. Teacher directed methods were shown to produce increased short-term retention in many studies (Ray, 1961; Wittrock, 1963; Hines, Cruickshank, and Kennedy, 1985).

Bruner (1961), however, had different results in his study of word-pairs. He divided twelve-year old children into groups that received either expository or discovery teaching methods. The subjects were instructed to remember word-pairs and were told that they would have to repeat them later. He found that those subjects who were explicitly given a rule associating the pairs (using the expository method) had worse results on his test of immediate recall than the discovery group who came up with their own associations between word-pairs.

Scott (1970) conducted a study on the effects of immediate recall, retention, and transfer using the methods of expository and discovery instruction when presenting geometry concepts. His subjects, sixth graders, were divided into two groups: expository and discovery groups. The subjects in the expository group were taught geometric concepts followed by examples in which relevant attributes were pointed out. The subjects in the discovery group were given examples of geometric concepts and had to create their own meaning. He concluded that neither group, expository nor discovery, seemed to have an advantage when a test of immediate recall was given.

A partial replication of Scott's (1970) study was conducted by Nelson & Frayer (1972). They studied the effects of instructional method on immediate recall and retention only, and had very different outcomes. Their study found that the expository group had significantly higher scores on tests of immediate recall than the discovery group.

Retention.

Research shows that the discovery method is overwhelmingly better than the expository method in terms of retention of knowledge. Another result from the study done by Rowell et al. (1969) showed that the discovery group faired better on the hieroglyphic-like symbols test ten weeks after the initial learning period. The researchers concluded that the discovery group's improvement was due to the participants' long-term arrangement of new knowledge into their existing knowledge constructs. Bruner (1961) he also found excellent retention with the discovery group in his word-pairs study of 12-year-olds.

Kersch (1958) conducted a study with 60 college volunteers. After separating the volunteers into an expository group and a discovery group, he taught them two rules of addition: the odd numbers rule and the constant difference rule. Consistent with the research presented so far, he found that although the expository group did better with immediate recall, the discovery group retained the material longer when tested one month later. He found that students in the discovery group continued to practice their new knowledge on their own after the initial learning.

In Scott's (1970) study of geometry concepts he found evidence to support his hypothesis that the discovery group would perform better on tests of retention. He discovered that the test scores of the students in the expository group declined over time while the discovery group's test scores increased over time thereby showing greater retention. Nelson and Freyer's (1972) replication of

Scott's (1970) study showed different findings, however. Although Scott found an advantage to the discovery method in terms of retention, Nelson and Freyer (1972) found no significant advantage for either group in terms of retention.

Logo is a list-processing computer language developed by Bolt, Beranek, and Newman at the Massachusetts Institute of Technology in the 1960's (Kenney, 1987). Logo uses turtle graphics (which is in effect an electronic sketchpad) that is used to create figures and other geometric constructs. Logo has been used in schools to promote the learning of geometric concepts through discovery and problem solving. Cook (1988) conducted a study in which high school mathematics classes were divided into two groups: Logo learning (discovery) and traditional (expository). Experienced teachers taught both groups. The Logo learning group met in the computer laboratory for a forty-five minute period every other day for fifteen weeks. The results of her study indicated that there were no significant differences between groups on retention.

Transfer.

Discovery learning, according to the research, does well with regard to transfer immediately after learning and over a longer period of time (Ray, 1961; Good, Forley, & Fenton, 1969; Rowell, et al., 1969). In their three-year study at Carnegie Mellon, Good et al. (1969) showed that discovery methods used in a social studies curriculum made individuals better learners. They concluded that the participants in the discovery groups were able to apply the concepts learned to other similar social science concepts.

Gagné and Brown (1961), in their study with 33 male ninth and tenth grade students, found that those that learned the principles of a number series through expository teaching did the worst on transferring their new knowledge to other similar situations. The discovery group had better results at transfer. Their results, therefore, indicate a discovery approach to teaching the derivation of new rules is best. They also concluded that learners that are given direction towards the discovery of new rules fair best on transfer than learners that are either explicitly given the rules or are left to their own devices to derive the rules (Kittle, 1957; Wittrock, 1963).

Scott (1970), in his geometry concepts study, did not show better results for the discovery group in regard to transfer. In fact, he concluded that neither approach had advantages over the other method of learning.

Expository teaching, however, seems better suited when transfer is necessary for standardized tests. Expository teaching gives learners precise and controlled bits of information that is amenable to these traditionally multiple-choice tests. Discovery instruction, where learners pursue more personal lines of reasoning, cannot be standardized (Keegan, 1995). Exam performance has been shown to be better when teaching techniques closely resemble testing methods (Godden & Baddely, 1975).

Conclusion

The research shows that each method of instruction, expository (objectivism) and discovery (constructivism), has its advantages. In non-specific subject area studies, discovery learning seems to be better for both retention and transfer while the expository method seems to be better for immediate recall. The implications, therefore to educational instruction seem to be enormous. If retention and transfer are primary goals of education then the available research indicates that the discovery method may be better than the expository method. Further research is necessary in order to shed more light on these conflicting research results.

On-Line Teaching

Until enough research is conducted to determine how on-line learning is best facilitated, we should at least be aware of what has been learned from the research conducted in the more traditional face-to-face learning format. As is the case in any learning situation, the teacher must be aware of what the desired outcome of the learning is to be. Planning to teach on-line courses does not mean the consideration of fewer of the dimensions of learning, but rather adds the dimension of the technology. The person or people who design, develop, and deliver on-line learning must still consider the teacher, the student, the content, and the pedagogy/andragogy in addition to the technology.

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The 2BeOn System
A Multimedia Workbench for Telework and Interactive Television Research

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Abstract: This paper refers to the implementation of the 2BeOn system, a multimedia workbench designed to test and evaluate the integration of communication and management services supporting work, leisure and information activities. The association of synchronous and asynchronous communication services is planned to provide a more complete answer to user needs in what concerns their interpersonal communication. The system results from a transdisciplinary effort and is being applied to support research in Telework and Interactive Television areas. Regarding Telework, the focus relies in building an integrated environment of communication, collaborative and management services to support remote work. From the perspective of Interactive Television the system aims to understand how the users may exploit online communication services, when engaged in leisure or information TV programs.

Introduction

Among the variety of Internet applications, interpersonal communication services are getting a substantial importance. The mass adoption of services like Instant Messaging (IM), mainly supporting informal communication (Nardi et al. 2000), and their availability in different devices reflects this trend. The 2BeOn workbench emerges from this context, enabling to test and evaluate practices of integration of communication and management services in two fields of application: Interactive Television and Telework. The general purpose of the system is to enable users "To Be Online", communicating or collaborating through the use of synchronous and asynchronous services.

System description

Being based on a server-client platform with all personal information (profiles) stored in the central database, any user connecting to any 2BeOn terminal, either on PC, TV or mobile devices, will get his customized environment and specifications. The system comprises the following main components:

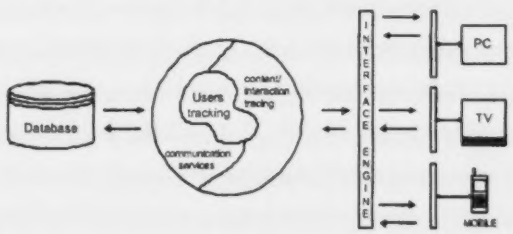

Figure 1 – 2BeOn's structure

User tracking - the core module of the system, that allows to verify the status of users (who is on/offline or in a break) and other traceable information;

Interface Engine - continuously applies the user's profile information to dynamically adapt the visualization and interaction interface based on a network of interrelated adaptable interface agents;

Communication services - synchronous (voice and video communication, chat, IM) and asynchronous (email, clip-email) services. The system applications lead to the development of specific collaborative features, such as: recommendation of TV program (TVPR), through text or voice messages assigned to video trailers automatically recorded during a TV session, and remote task assignment to work colleagues (on a team work scenario).

Content/interaction tracing - designed to improve users collaboration by allowing to search and contact other users based on their topics of interest or work competencies. For this the system performs a constant analysis of the users' patterns of interaction: peers contacted, TV channels viewed or intensity of use of communication services.

The system uses customized and customizable software agents that, dealing with information from different services and from the online database, can, e.g., select the online communication device that can reach the addressee in a more efficient and direct way.

Application areas

The workbench is applied to different research areas, with adaptations on the interface interaction and the development of specific features oriented to each research area: Telework and Interactive Television (ITV).

The application of the 2BeOn system for remote work scenarios focuses on the following research concerns: i) What are the major guidelines for the development of a telework oriented multimedia communication environment; ii) In what manner the integration of communication and management services, complemented with automatic support mechanisms, is able to improve communication between co-workers. It is believed that this environment act to increase the effectiveness not only of individual teleworkers but of their fellow members as well (Niles 1997); iii) How the dynamic creation of work groups may improve the work performance and contribute for the promotion of work communities; iv) How can the system assist the work progress by synchronizing processes and helping the user in finding information, tracking competencies or controlling his or other tasks?

In the context of ITV, the system aims to promote interpersonal communication by using communication services to discuss common themes or by using TVPR. This type of application differs from the emerging forms of ITV, which are basically oriented to on-demand gathering of information and access to dedicated services (Stewart 1999), but not to the promotion of interpersonal communication. In addition to study how TV users can exploit the 2BeOn features, the research also comprises the following topics: i) How to cope with the technical limitations of the TV as an output terminal; ii) What is the relation between TV content and the establishment of conversations; iii) What is the relation between the use of communication services and TV consumption, in the users perspective; iv) How can the system help to reinforce the socialization between communities of interest?

Evaluation procedures

The evaluation adopted until this moment, based on interviews, has shown that the integration of communication services satisfies the users. The data mining provided by the internal register mechanisms enables to evaluate and detect necessary changes to the inner structure of the system. The formal evaluation procedures will be addressed by means of: i) online questionnaires/interviews, supported by multimedia demonstrations of the system's features (for details see http://www.ca.ua.pt/2beon); ii) qualitative and quantitative testing of the working prototype.

Conclusions and future work

The developed workbench has proven to be capable to support research in interactive television and telework areas in the field of interpersonal communication, collaboration and management activities. The experience has also shown the potential interrelation between both areas. For example, Interactive television may act as an additional terminal to stay alert to work and perform some basic tasks.

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The Effects Of College Students' Educational Level And Gender On Their Use Of The Internet As: (A) An Instructional Tool, (B) A Research Tool, (C) A Communication Tool, And (D) An Entertainment Tool

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The main purpose of the present study is to investigate the pattern of the Internet use by Ohio University students in educational activities in four domains: (a) as an instructional tool, (b) as a research tool, (c) as a communication tool, and (d) as an entertainment tool. It focuses on the gender and educational level as potential factors influencing the use of the Internet among college students in the four domains. Using quantitative research methodology, the data were collected through a survey completed by 800 students from Ohio University. Two-way ANOVA was conducted to investigate whether or not the statistical differences revealed in the descriptive statistic results were significant. Chi-Square statistical procedure (crosstabulation) was used to examine the relationship between the independent variables (gender and educational level) with other variables such as computer ownership, hours of use of the Internet per week, and the correlations between students' GPAs and their use of the Internet. Findings from the study reveal that gender evidently plays a significant role in the overall use of the Internet in daily activities. Males still generally dominate the use of the Internet in the four mentioned domains. More graduate students use the Internet for instructional, research, and communication purposes than undergraduate students. At the undergraduate level, this study interestingly reveals that more female students use the Internet for research and communication purposes. It is also revealed that more male undergraduate students use the Internet for entertainment purposes. The descriptive statistical results show that fewer female graduate and undergraduate students, as well as male graduate students, use the Internet for entertainment purposes. The study indicates that students' GPAs have significant, positive correlation with the use of the Internet as an instructional tool, a research tool, and as a communication tool. However, it is indicated that the correlation between students' GPAs and the use of the Internet as an entertainment tool is negative and not significant. It is concluded that gender and educational level are relatively effective predictors in looking at the pattern of college students' use of the Internet the previously mentioned domains.

Attitudes of King Saud University Faculty Toward Development and Implication of a Telecommunications-Based Distance Education Program as an Alternative to Conventional Teaching

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Today, institutions of higher education in Saudi Arabia are faced with the problems of overcrowded enrollment and lack of sufficient facilities to provide appropriate educational services to the country's qualified students. Many students do not have access to higher education because they live in remote areas and do not have any means of transportation to attend on-campus programs. Many others would like to participate in college or university programs, but are not able to do so due to a number of personal problems such as commitment to their families, their jobs, and lack of necessary programs suitable to their future needs. During the past few years, Saudi higher education institutions have been debating the feasibility of implementing distance education programs as an alternative to regular classroom instruction. King Saud University has recently taken the issue more seriously and is seeking an immediate solution to the problem. For such reason, this research study was conducted to investigate faculty attitudes toward development and implementation of a telecommunications-based distance education program suitable to the needs of Saudi students. The resulting analyses of the collected data led to the following conclusions and implications. 1. Although a vast majority of the participating faculty members had little knowledge of using a computer, most of them demonstrated positive attitudes toward the feasibility of facilitating students with distance education programs as an alternative to traditional on-campus classroom instruction. 2. A majority of the faculty members believe that the success of a distance education program is ultimately dependent on a number of institutional strategies, including sound policies and procedures, compatibility, quality assurance, adequate course offering, appropriate faculty training, necessary staff and administrative support, reasonable faculty workload, and satisfactory faculty rewards. 3. Certain personal and professional characteristics of the faculty members were found to be influential in their attitudes toward the use of computers and communication networking facilities for distance education. Finally, the study concludes with several recommendations to Saudi institutions of higher education and other interested groups as well as a number of suggestions for future research on the issue of distance education.

Traditional Classroom Evolving: E-Learning on the Horizon

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Abstract: The traditional classroom and traditional teaching are not mutually exclusive from the new and exciting innovations that e-learning is bringing to the teaching and learning processes. In actuality, the traditional classroom is embracing these new paradigms of pedagogy that are dramatically changing the content of curricula and course delivery methods, and the pace at which these new methods are being adopted by academia is increasing significantly. This presentation brings to the forefront how these emerging technologies are opening an exciting new chapter in the rich history of the traditional classroom.

As time progresses, so too does technology within the field of higher education. Nearly 40 percent of all college classes used Internet resources as part of the syllabus in 1999, compared with 15 percent in 1996 (Web-Based Education Commission, 2000). In general, Internet usage has increased dramatically. In 1996, Amazon.com, the largest Internet bookstore, recorded sales of less than $16 million. In 1997, revenues increased to $148 million (Applegate, McFarlan, & McKenney, 1999). In the educational system, 64 percent of schools in the United States have Internet access today, a figure up from 35 percent in 1994 and 50 percent in 1995 (Coley, Cradler, & Engel, 1999). Web technology represents one of the most rapidly expanding fields, taking only three years to reach 50 million users, while radio technology took 50 years to reach the same amount of users and television took 15 years. The incorporation of technology into the higher educational system seems vital because technology will supplement education to work for the advantage of all those it touches. So far technology has already penetrated the education of higher institutions and proved successful by giving the forum a new perspective. The introduction of technology has created many complications because much of the population has a difficult time adjusting. Solutions exist, though, and when activated, the growth of technology will prove successful in transforming the learning environment.

Many goals have existed in the educational system since the beginning of education. These goals have included: to center learning around the student instead of the classroom; to focus on the strengths and needs of individual learners; and to make lifelong learning a reality. With extra enhancement from technology, these goals become attainable. "The process for bringing new content into the curriculum in higher education is often slow by corporate standards," (Harris, 2001). Therefore, technology becomes fundamental to keep the educational system current. "E-learning is getting a faster start as a supplement to classroom teaching than as a pure delivery channel," (Zastrocky & Yanosky, 2001). This insinuates e-learning does not try to replace the traditional higher education institution, but rather attempts to complement the conventional approach to teaching and learning. Technology does not aim to exchange teachers for computers, but endeavors to do more with what we already have and use. "Investing in the development and support of skilled teachers...offers great promise," (Web-Based Education Commission, 2000). By itself, e-learning will not increase test scores or ensure educational equity for all learners, but it will help aid the journey to attain these goals. Technology offers "Opportunities to expand individualized learning, provide access to a much broader and richer set of educational materials and human resources and promote learning-to-learn skills (Web-Based Education Commission, 2000).

Recently, corporate universities have emerged to compete with traditional learning institutions. These corporate universities base themselves solely on technology. Traditional colleges and universities must do a better job reminding their "customers" why they operate the way they do and must reclaim the high ground in the competition to attract traditional and non-traditional students. Higher education must refine its "marketing message" to incorporate corporate university ideas. Without integrating technology into schooling, the corporate universities will surpass traditional universities in contemporary education.

Traditional universities do have an advantage of objectivity over corporate universities, thus protecting the interests of their students while promoting the principles of liberal arts education and lifelong learning. Many corporate universities do not realize, "The focus must not be on learning objects, but must be on the object of learning." In addition, " 'real' universities have an advantage over corporate universities because the traditional university's breadth of disciplines, its role in research, and the relationships it fosters between faculty and students," (Zastrocky & Yanosky, 2001).

Overall, a traditional university is better positioned to pay closer attention to the student's developmental needs by creating a learning environment conducive to critical thinking and lifelong learning. "Institutions of higher education have several strengths that are not found in other instructional environments, [including] dedication to independent research, academic freedom, and the ideal of student enlightenment leading to wisdom," (Harris, 2001). Most importantly, "The excitement and stimulation of a comprehensive intellectual life probably remains the university's greatest competitive differentiator," (Zastrocky & Yanosky, 2001).

However, when technology combines with the conventional higher education environment, the best circumstances under which to learn becomes reality. "Technology gives us the power to provide access to information and guidance in every dormitory room, after all, and we need to think how to use that power in conjunction with the physical presence of faculty members and facilities," (Katz, 2001). With technology in use, even more outlets become available for students to turn to. "Technology has affected more traditional student relationships by making possible a wider variety of online administrative services, emphasizing the 'customer service' aspect of student relations – simply browsing the Web exposes students to an immense variety of resources, including multimedia material, that in sheer size dwarfs the collections of the largest university libraries," (Zastrocky & Yanosky, 2001).

The traditional university atmosphere must not dramatically be altered to make way for the corporate learning philosophy because the interaction between faculty and students proves necessary to maximize learning. "Many new online degree programs take a hybrid approach to achieve both community and convenience for a student cohort, interspersing brief periods of face-to-face interaction with longer periods of remote distributed instruction," (Harris & Yanosky, 2000). The face-to-face relations provide a student with an experience for objectivity. In addition, a faculty member can provide concepts and views that the student may have not yet explored. "Even when students stay within disciplinary boundaries, they benefit from the faculty's participation in a larger community of ideas and approaches," (Zastrocky & Yanosky, 2001). With the implementation of technology within the higher education setting, teachers and students work together to accomplish a goal, unlike corporate universities, which force the students to conquer goals independently. "While technology can help a student overcome learning problems, the student and teacher must still put forth a great deal of effort and hard work...Faculty still must prepare hard and long and be part of creating "new knowledge," and students still must study to prepare for the world ahead of them," (Zastrocky, Harris, & Yanosky, 2000). With these ideas in mind, "The higher education faculty/student relationship is one in which a professor with deep expertise and a strong commitment to nurturing and advising inspires his or her student to higher levels of achievement, and provides a role model for humane, dedicated professionalism...[this serves the] 'students' personal development and intellectual growth," (Zastrocky & Yanosky, 2001). This "personal development and intellectual growth" cannot be attained at a college level sans the professor interaction and technology. Studies have shown "...Higher student graduation and completion rates in distributed learning courses when online instruction was conducted by traditional departments rather than separate specialized distributed learning units." This suggests direct faculty contact remains a key component of student success, a facet not attainable through a purely corporate university atmosphere (Zastrocky & Yanosky, 2001).

E-learning in the conventional university atmosphere has many advantages. Content portals and online resources provide an excellent improvement for textbooks and reading lists. Multimedia and interactive content can supplement the traditional chalk and talk method of teaching. Most importantly, parents can be updated on their children's progress constantly with real-time student information systems rather than just report cards every quarter or semester. "Institutions with rich, Web-enabled applications for communications, collaboration and e-commerce will have the strongest competitive advantage if these innovations move the institution toward its educational mission," (Harris & Yanosky, 2001). Traditional universities can add technology without changing the status of the university, but corporate universities cannot add faculty without defying the university's original intention of solely technology. The corporate university cannot be modified into a primary outlet of education, but it remains possible to rework the traditional university to attain this goal.

Steps that traditional higher education institutions must take in order to ensure competition for corporate universities include: web access to students' enrollment and advising; PC access for every student and faculty member; full suite of knowledge applications, including messaging, calendaring, and collaboration; 24/7 technical

support; faculty and student access to a learning management system; library with growing digital collections and search capabilities; and enterprise portal including e-commerce capability. In addition, traditional universities must have a strong Website presence and Internet access in teaching environments (Harris & Yanosky, 2001).

The first step to transforming a conventional institution of higher education into an e-learning environment consists of "...mapping out the relationship between the learning environments [the universities] wish to foster and the bandwidth access needed to reach desired student population (Harris & Yanosky, 2000)." The Web-Based Education Commission's counts regulatory change, e-learning research, and e-learning training and professional development among the other vital characteristics of an environment attempting the incorporation of e-learning. Regulatory change consists of relaxing some of the education rules, for instance, the rule stating at least 50 percent of instruction is to be done in the classroom. If this rule was more lax, teachers could assign more Internet assignments, requiring the use of the Internet within the home. E-learning research calls for increased funding, which the Web-Based Education Commission deems necessary for the progression to e-learning. The nation's universities should make the development of highly skilled educators their most important priority, which falls under the e-learning training and professional development category (Yanosky, 2001). The Multimedia Educational Resource for Learning and Online Teaching (MERLOT) is a "collection of online learning materials and support resources to help faculty enhance instruction," (Web-Based Education Commission, 2000). With devices such as MERLOT, universities are well on their way to accomplishing the traditional university atmosphere while at the same time intertwining e-learning. It is impossible to create this type of environment, however, without taking the necessary steps for accomplishment. "...Technology is not something that happens to us. It is something we create. We must not confuse a tool with a goal," (Katz, 2001).

"The Internet is bringing us closer than we ever thought possible to make learning of all kinds, at all levels, any time, any place, any pace – a practical reality for every man, woman, and child," (Web-Based Education Commission, 2000). Already the Internet has shown its glory in corporate universities. Growth in corporate universities can be attributed to: traditional business schools seeming too far removed from the pulse of the business world, enterprises realizing that developing people is key to future survival, and advances in technology allowing companies to economically and effectively deliver distributed learning causing the learning to become continuous and immediate (Harris, 2001). An example of e-learning at work evidenced at Hundred High in Wetzel County, West Virginia. Hundred High received infrared ports in every classroom, allowing students to connect all over campus. Not only did this increase test scores above the national mean in every subject on the Stanford Achievement Test, but it also allowed students to discover themselves through the Internet. Scott McGlumphy, a mediocre student at Hundred High before the infrared ports, accumulated an interest in anthropology in addition to top grades. Web-based learning environments prove so successful because they provide support and challenge through representation, expression and engagement. Web-based testing may ask students "...to place works of art along a timeline, to design a building to meet a set of constraints or to troubleshoot a faulty system." Students then become part of their assignment, rather than just a spectator (Web-Based Education Commission, 2000).

In general, technology allows a lot more interaction and individualism students can learn at their own pace. For example, New Jersey's Hunterdon Central Regional High School created an online magazine, *Electric Soup*, with the help of English teacher Florence McGinn. McGinn wanted to use technology to "...open up opportunities for individualized learning and challenging her students to take on fresh, empowering roles" (Web-Based Education Commission, 2000).

Other positive aspects of the Internet include: offers education in places where there is none and extends resources where few exist, connects people, communities, and resources to support learning, extends learning day and place, adds graphics, sounds, videos and interaction to give teaches and learners multiple paths for understanding. (Web-Based Education Commission, 2000). With technology, a student in even the most remote settlement can have access to the same references as a student located in the most cosmopolitan city. This use of technology creates the perfect circumstance for distance education. Even elite universities are hungry to get into distance education. "Collaboration for distance learning will help bring together larger institutions and colleges and smaller universities," (Katz, 2001). Technology demonstrated its usefulness in the medical profession when six patients were given heart procedures in Israel, Italy, and New York City with three to eight cameras present in each locale to broadcast the operation to 7,000 cardiologists. This allows cardiologists not present for the operation to receive the same experience as if they were in attendance (Web-Based Education Commission, 2000).

Technology acts as the "equalizer" of education, allowing students access to libraries and research centers everywhere. Even students in the most poorly funded districts will have the same access to materials as wealthy students. This becomes beneficial because, for instance, only 60 percent of high schools offer Advanced Placement courses, but a private sector provider, APEX Learning, provides courses in 10 AP subjects online, as well as AP

preparatory materials (Web-Based Education Commission, 2000). This increases the use of distance learning that so many universities yearn for.

Time signifies another element that loses relevance in the learning environment when technology becomes involved. With technology, a student can download a copy of a book long after the library closes. This extricates some of the boundaries currently placed on learning and allows the "extension of the learning day and place."

E-learning can provide the solution for minor problems that have long lingered in the educational system such as overcrowding, inadequate textbooks, and lack of parental interaction. "Zurich, Switzerland's top universities are working [to solve] a surplus of students and limited budgets...The Swiss Virtual Campus will relieve crowded university classrooms while improving teaching practices and keeping a lid on costs," (Studer, 2001). In addition to ceasing the problem of overcrowding, technology allows easier transportation of books as well as consist revisions and updates because corrections can be made to the sources immediately. Instant attention will also be given by the facilitation of parental interaction by increasing the communications between the classroom and home. With the Internet, parents can be kept up to date by e-mail use, web castings of daily classes and grade postings on the web.

Information technology helps in the conventional institution of higher education by bringing visualization of difficult concepts through graphical displays or video presentations, performing tedious calculations to test theories and build bridges to understanding, using virtual reality and simulations, enabling Web-based "virtual field trips" that allow students to interact with museum collections and scientific experiments, and creating extra institutional learning communities that bring together students and instructor who share common interests in a subject (Zastrocky, Harris, & Yanosky, 2000).

For e-learning to be advantageous, it must become the standard in American higher education, not the exception. "The biggest barriers to learning [technology] are money, time, and fear," (Web-Based Education Commission, 2000). In 1999, the barriers to e-learning included: not enough computers (78%); lack of release time for teachers to learn computers (82%); and lack of time in schedule for students to use computers in class (80%) (National Center for Education Statistics, 2000). The fact that not enough computers exist in the school system can be attributed to the federal government providing only 6.1 percent of all elementary and secondary education funds (Web-Based Education Commission, 2000). Currently only $3 billion is spent on technology, averaging to $70 per pupil. For all students to reap the benefits of technology, $15 billion must be spent, or $300 per student (Coley, Cradler, & Engel, 1999).

Other issues that stymie e-learning include high costs of equipment and instructor training, increased demands on instructors time, limited computer access in less affluent areas and lack of information in the necessary format. The Web-Based Education Commission's Report recounted the costs for technology as including payments to utility and Internet service providers, technical support, instructional content, trained educators and administrators, and upgrades as newer equipment become available (Web-Based Education Commission, 2000).

Trained educators and administrators represent the most essential element to an effective e-learning system. As maintained by the National Center for Education Statistics, "...teachers who perceived that lacking computers and time for students to use computers as great barriers were less likely than their colleagues to assign students to use computers or the Internet for some instructional activities." Teachers were more likely to use technology and the Internet when the technology was available to them, available in their classroom, and available in greater numbers (National Center for Education Statistics, 2000).

Even when technology becomes more readily available in higher education, there must be more enthusiasm on the part of faculty to gain the necessary skills to utilize these new technology tools in the classroom. "Only 15 percent of U.S. teachers reported having at least nine hours of training in education technology in 1994" (Coley, Cradler, & Engel 1999). The National Center for Education Statistics said, "...Teachers who reported feeling better prepared were more likely to use these technologies than their less prepared colleagues." Furthermore, educators must be willing to dedicate some of their own time to learning about technology as "Teachers cited independent learning most frequently as preparing them for technology use (93 percent)." (National Center for Education Statistics, 2000).

Activities signify an appropriate preparation for computer-based learning as "Teachers who spent more time in professional development activities were generally more likely than teachers who spent less time in such activities to indicate they felt well prepared to use computers an the Internet for instruction" (National Center for Education Statistics, 2000).

The goals for technology must be met in order for the system to utilize its effectiveness. There must exist greater access to broadband connectivity, guidance in the best uses of the Web for learning, understanding of how people learn differently with the Internet, and content that leverages the powerful capabilities of the web (Web-Based Education Commission, 2000). Steps for the universities to push towards e-learning consist of: organizing lobbying strategies for what is likely a busy season in educational legislation; designing more flexible e-learning

programs to reach non-traditional learners; and developing action plans for a quick institutional response to new opportunities in education research and teacher training (Yanosky, 2001). "Institutions that put the right technologies together with the right strategies, tactics, and processes, and have the right skills in place," will attain an effective staff (Nelson & Zastrocky, 2000). An effective staff will be made though, not born.

The most important ingredient is the presence of a local hero with the vision, courage, and stamina to challenge status quo. Growth with technology can be attained through partnerships that bring together the federal government, state and local agencies, the private sector, and educational institutions. The Congress and Administration must create an e-learning agenda aimed at assisting local communities, state education agencies, institutions of higher education, and the private sector to maximize the power of the Internet for learning. A call to action to help implement the e-learning agenda should incorporate policymakers and politicians, college presidents and parents, teachers and teacher educators, and students and business leaders (Web-Based Education Commission, 2000).

Already steps have been taken within the government to help implement e-learning within institutes of higher learning. Education is the Bush administration's top domestic priority and e-learning is one of the most politically attractive components of the education agenda. Even partial implementation will be beneficial. "President Bush's first communication to Congress was a K-12 agenda which, though primarily focused on the accountability and school choice, called for 'increased funds to schools for technology' through a consolidation of federal technology programs," (Yanosky, 2001).

Testimonies from the community showed the Web-Based Education Commission there was a need for powerful new Internet resources, such as broadband access, continuous, relevant training for educators, new research on how people learn in the Internet age, high quality online educational content, relief from outdated regulations that impede instructional innovations in any time, any where, any pace learning, safeguards to protect privacy, and sustained funding. A research program to set up the framework for this e-learning agenda can be attained by establishing a benchmark goal for federal investment in web-based learning; focusing on high payback targets of educational opportunity where present links between learning theory and technological innovation appear particularly promising; supporting the creation of learning communities and tools for collaborative knowledge building and dissemination among researchers, teachers, and developers; and supporting a sustained effort to track the use of the Internet in education and how the web is transforming learning (Web-Based Education Commission, 2000).

To increase technology, the education community also must continue the current voluntary system of accrediting higher education institutions and programs, create mechanisms for users to share their commercial and noncommercial resources and experiences regarding online courses and programs, articulate frameworks for what constitutes good online courses and encouraging private sector education providers to develop their courseware in concert with these frameworks (Web-Based Education Commission, 2000).

"Banks and retailers, food and beverage companies, and clothing manufacturers all need employees with greater technical capabilities than our schools are currently providing to fill the high-skilled jobs necessary in today's economy," states the Web-Based Education Commission's Report. Thus e-learning is deemed essential within the educational system of higher learning for cultivation of a workforce prepared to meet the challenges of lifelong learning. The merging of innovative applications of technology with the traditional classroom creates an atmosphere conducive to the changing pace of today's global citizenship and global economy. The technological advancements created and utilized through e-learning in institutions of higher education will most surely supplement the quest for a "new breed of literate citizens" capable of dealing with the modernization of today.

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The Vision of an Interplanetary Individualized Virtual University in the Age of Globalization.

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Abstract: The new technologies of communications and information, together with the Internet boom, help create a totally different environment in the sensitive area of education. The process of globalization pushes towards the creation of a uniform economic, social and cultural environment, which veils the national peculiarities of the state entities. Sooner or later, the educational systems will be called upon to converge with the choices and needs of the new global financial model. The new educational technologies of the Internet lay the foundation for a new interplanetary educational system, especially in the area of universities. The delineation of the basic traits that will govern the new worldwide virtual individualized university is the main objective of this work.

Introduction

The rapid development of the new technologies of communications and information (Dutton, William,1996), in conjunction with the massive use of computers and the Internet boom (Morneau Jill & Anderson Kim, 2000), create new data at an international level. The transfer of capitals in the new technological environment released a gigantic power on the part of international capital market. The very rapid and secure flow of vast amounts of funds towards every direction created the conditions for the consolidation of the phenomenon of globalized economy (Eichengreen, 1996). The advent of globalization has a catalytic effect on almost the entirety of economic, social and cultural life of the developed – and not just the developed – world (Melas, 1999).

The educational systems are called upon to serve the new dogma, the new vision, the new reality. This is the dogma of the free, according to many (Friedman, 2000), or wild, according to others (Deppe, 1995), market. The vision of free, according to the powerful ones, or the nightmare of unbalanced, according to the weak of our modern world, access at a planetary level. It is the reality, according to the financially developed states, or the imposition of worldwide financial suzerainty upon the social edifice, according to the developing world. Conventional educational systems are unable to keep pace with the demands of a world where the universal spiritual values show signs of weariness compared to the respective material ones (Anastasiades, 2000). Based on the above approach, the materials that will build the new model of interplanetary individualized university have already started to take form.

Thus, in this work, the author is giving, from his viewpoint, a detailed outline and expounds the basic features of the interplanetary virtual individualized university. The structure of the work is as follows: In the second part there will be a brief mention to the basic concepts that constitute the new educational environm ent. In the third part, there will be an analysis of the concept of the individualized virtual university, through the use of a theoretical example. Finally, the conclusions of the work will be presented in the fifth part.

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The Virtual – Potential University

The new technologies of communications and information change radically the area of education. Open and Distance Learning is defined as all the knowledge and skills gotten through indirect information and guidance, which includes all the technologies and other forms of distance learning. (U.S. Distance Learning Association, 1998)

The educational material is getting innovated with the aid of advanced multimedia applications (Collis, & Smith, 1997), which help create an interactive cooperative distance environment for the students.

The global internet is the unified technological and information platform (Washington DC, 2000) where technologies, educational materials and methodologies converge.

The European Union and its member states are taking careful steps towards the new directions coming into sight at a worldwide level. The priorities and objectives relating to the use of the new multimedia technologies, and especially the Internet, in the area of education are clearly defined as part of the action plan of the European Union e-learning (EU COM(2001)172 Final).

At this point, it is quite important to demarcate the concept of virtual university as distinct from the term of "open university".

According to (Peraya, 1994), there are two different classes of adults, corresponding to two different models of distance learning.

The model of Open University satisfies the educational needs of adults who wish to improve their knowledge and skills, with the main objective of upgrading their professional qualifications.

The model of virtual university is addressed to groups of adults who wish to attend a complete course of study and get a certificate.

The meaning and content of the individualized interplanetary virtual university

The conventional educational environment (Kaye, Rumble, 1977) or, in other words, the first category of teaching activities (Moore, 1977), served quite successfully the social and financial needs of an era which seems to fade away with time. The new technologies of communications and information make possible the development of a totally different educational environment, by means of the "educational technologies", as they are called (Hawkridge, 1976).

One of the characteristics of the new technological age in the area of education will be the transition from a student-centered education (Delling, 1994) to the concept of independent studies (Wedemeyer, 1973). This encourages the development of a flexible educational system, which will be able to adjust itself to the needs and demands of small groups or even individual trainees.

The individualized environment of education would be defined, as part of this study, as that model which encourages the student to freely and independently select the courses, teachers and university departments, in order to become qualified in the faculty or subject of his preference.

The materialization of an open and pluralistic learning environment cannot be restricted within the finite limits of a country or university, as they are today. It requires the constitution of supranational educational entities, as part of which unified criteria for the evaluation of university departments will be established, and at the same time students will be encouraged to take part. Typical endeavors in this direction, in the European area, are the proclamations of Prague and Bologna .

The United States of America will be able to move more easily in that direction, utilizing their multiyear federal experience.

The next step in the development of the new virtual model will be the effort to homogenize the curricula of the university departments. This could be achieved through the development of a flexible structure, which will include branches, sections, subjects and studies leading to specialties, faculties etc.

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In the area of information technology, for example, the respective departments tend to align their curricula to internationally accepted standards (Computing Curricula, ACM- 2001).

Thus, the development of a uniform system of evaluation, the homogenization of curricula and the establishment of open and clear systems, will encourage students' mobility in the virtual university spaces which are being formed. From the students of a single university, we go rapidly to the students of the interplanetary virtual university. Further analysis of the suggested model will be attempted through the use of a theoretical example, which will try to give the routine of a student and a teacher in the new reality.

The student

The entering of students to the unified virtual university area will be unrestricted, meaning that the trainees will not necessarily choose to study in a certain university. They will choose subjects, faculties and studies that will be established through the selection of a certain number of courses – mandatory and optional – which might be offered by different university departments, probably in different countries around the world. This means that the students of the new educational model will select their teacher and course and not necessarily a certain university or faculty, as they did up to now, creating a pluralistic teaching package that will correspond to their own needs and desires.

Through a homogenized supranational system of evaluation (a combination of the leaving certificate degree with examination results as needed), the students will secure the right to study with certain teachers, depending on the courses they choose.The difficulty encountered by the students in securing certain teachers and, therefore, certain courses, will be dependent on the supply and demand that will be established in the unified virtual university area.Thus, it is highly probable that in the future we will no longer have university or department graduates, but graduates of faculties and subjects who will have selected courses, major and optional, delivered by teachers of their own choice in different universities, maybe even in different countries. The individualized educational environment for the new type of students of a unified virtual university starts becoming a reality.

The teacher

The teacher will be called upon to operate in a totally different environment, where the students will have selected him because they trust his work and not just based on the reputation and influence of the university he is working in.

On the other hand, the teacher will be constantly evaluated based on the level of students he was selected by, reversing the reality of today, which many times forces him to engage in research at the expense of teaching.

Most probably the teachers will continue to belong in university departments, which will provide them with authority and all the necessary equipment, as well as the administrative structure they need in order to deal successfully with the high demands of such a model.

The University

The university and the respective departments will be called upon to adjust their operation to the new data, without however being themselves in danger. They will continue to be the authentic authorized regulatory structures that will see to the development of the proper educational environment.

The difference is that they should now be able to support, at a technological, pedagogical and administrative level, that environment where the new individualized model of virtual teaching services will be able to thrive.

At the same time, the degree of acceptance of the teaching personnel of each university by the new type of students will greatly affect both the evaluation of the departments and the universities in whole, expanding the procedure and the content of evaluation.

Conclusions and future research

The new educational technologies, and particularly the technologies of communications and information, provide the necessary multimedia and internet tools in order to realize the vision of open horizons education. The development and estab lishment of a supranational homogenized teaching and administrative environment in the area of higher education creates the conditions for the formation of a new individualized virtual learning model at a planetary level. The new university model will be called upon to answer the challenge of globalization and the ever-increasing demands of the labor market. At this point, a serious question arises in relation to the driving force behind the developments in the area of higher education, and this is economy and the needs of the enterprises. If this turns out to be true, then all of us need to deliberate on the future and outlook of higher education. We need to deliberate on the pedagogic and cultural consequences, the factor of language diversity, and the risk of eliminating all those peculiarities, which ensured global variety, as part of the conventional educational system. We need to consider the appearing social dimension of an interplanetary learning model in the area of higher education. These are issues, challenges and questions that will be the target of future research endeavors.

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Issues on Modelling Distance Learning Environments

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Abstract

This paper presents a framework for modelling distance learning environments. These learning environments may be either supported by informations and communication technology or in a computimg system. In this paper, the process of constructing a learning environment is seen as a modelling process, similar to the software development process in software engineering, where every phase must be accomplished in order to provide an adequate adaptation of the student to the environment. This framework is being used by the research team at the Distance Learning Education group - PUCRS Virtual - to create and monitor extension, undergraduate and "latu-sensus" graduate courses.

1 Introduction

Developing learning environment is much more than to translate ordinary classes to a communication and information technologies based environment . This process begins with the design of educational elements (or pedagogic architecture) and a software engineering study.

This paper sketches the main phases of the development process of such learning environments. These phases do not follow a strict order, as to allow the designer to better adapt the environment to its intended use, and to provide some freedom to the development team.

2 Learning Environment Modelling

The framework proposed for the construction of learning environments is divided in six phases. The first phase refers to educative design, phase 2 to computational modelling, and phase 3 to implementation of the environment. Phases 4, 5 and 6 describe environment evaluation from a pedagogical perspective, taking into account issues as ergonomy and usability.

2.1 Educational design

The first phase in the learning environment construction refers to the educational design, basically the definition of the pedagogic architecture of the environment. This phase should be performed by a team constituted by professionals with large experience in teachers' education and preparation, with a critical vision of the use of technology in education, experts on the course contents and with wide knowledge about computation, especially computer networks and hypermedia. In this phase is important to check the following information:

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Public's identification
Definition of the goals
Definition of the subject area
Definition of the specialisation-area
Content definition
Definition of the teaching and learning strategy
Definition of the types of tasks (learning of concepts, problems solution, project development, knowledge construction, forum of discussions etc)
Definition of the interaction styles (synchronous / asynchronous)
Definition of the interaction degree (high, low) of the activity (example: problem solution -high)
Definition of the group activities: (co-ordination of activities, decision making, brainstorming etc)
Definition of work schedule
Definition of roles: the student's role, the teacher's role.

Table 1: Pedagogic requirements

In the context of learning environments the pedagogical proposal should promote autonomy and critical thought. Besides, the pedagogical goals should be linked with a list of methods associated to traditional activities and a list of the possible methods associated to distance activities.

Traditional class	Distance class
Printed class notes are distributed in the first class.	Class notes are available at the Web some time prior to the first class.
Questions are asked and answered in classes.	In order to reduce the time that the lecturer uses with explanations, questions and their respective answers are organised in FAQ's. Questions are asked through electronic mail, for instance.
The students' list is supplied to the teacher in the first class.	The students' list and their respective e-mails are available for everybody at the beginning of the course.
The dates of exams are defined by the lecturer, accomplished in the defined days and checked by him.	Exams are checked automatically and offered in regular opportunities.
Application of evaluations at the end of each unit to verify the student's performance. The students follow the normal rhythm of the group.	From the exams the lecturer can verify the performance of the student step-by-step and to identify those students with difficulties. Then, the lecturer can organise small tutorials or discussion teams for such students. They can also follow the exams in your own rhythm.
In the traditional classes the lecturer works with large groups and it stimulates the collaboration through exercises and activities in the lab.	In the distance approach is important to plan meets by chat in order to provide the direct interaction between lecturer and students. Also communication tools will be welcome to announce general subjects or discussions for the team. A Webpage to obtain a feedback of the students.

Table 2: Traditional *versus* distance activities

2.2 Computational Modelling

A learning environment can be supported by communication and information technologies (C&IT) or by a computing system. These two forms present pros and cons. A computing system is a "closed package" where

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very often it is very difficult or impossible to modify parts of system. Besides, an environment based C&IT is an user system interface supported by hypertext and elaborated through a language for formatting of information in the Web. So, the primary goal of a Web page is to propagate information and not to constitute an learning environment.

The second phase refers the computational modelling of the environment that will be implemented through a Web page. This phase follows similar structure to the technical requirements of a traditional software.

The project of the learning environment has as starting point the pedagogical proposal and as product a computational environment designed as integration of media, services and Internet tools as well as by computing systems. The requirements of this phase are the following:

Storage way: web, CD-Rom
Definition of the computational environment or programming language
Definition of the tools and services of the Internet
Definition of the computing systems
Definition of the modules related with other research areas: artificial intelligence, virtual reality, database etc
Definition of the requisites necessary to the development: software to graphic support, CD-Rom recorder etc

Table 3: Computing requisites

The project of the environment graphical design should consider the following aspects:

Definition of the electronic and printed media (hypertext, text, sound, image, animation etc)
Elaboration of materials (edition of texts, sounds, images etc)
Selection of images and sounds
Creation of a virtual library
Definition of colours patterns
Elaboration of the graphical design
Elaboration of the conceptual maps and of the contents modelling
Final check of the project

Table 4: Requirements of the learning environment project

In order to provide a learning environment by Web page, the elements need to be linked in such a way that is possible to introduce or to illustrate concepts, accomplish experiments, activate tasks and motivate the social interaction. The next table presents a parallel between and Web page and learning space:

Web Page	learning space
Class notes are available in order to facilitate the access to the material used in the classes.	Class notes are available with the objective of student can read the material before the beginning of the course.
The FAQ is available with the goal of informing on technical aspects in the use of computing systems.	The FAQ is available with the goal of socialise the information classes, it means to inform on technical aspects about the use of computing systems and on theoretical aspects of the course.
The students' list is available with the goal of make easier the verification the inscription in the course and	The students' list besides make easier the verification the inscription in the course and the access of the

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the access of the exams result.	exams result is made available with the goal of facilitating the contact between students and lecturers.
The list of exercises is available with the goal of facilitating the access to the exercises and verify the knowledge about the contents presented in the course.	List of exercises: The same that the Web page
The exams preparation is made by a list of solved exercises offered to make possible the auto-check by student, identify their difficulties and clarify its together the lecturer.	The exams preparation is made trough of tests with automatic correction. These tests are offered to make possible the teacher to accompany the acting of the student step-by-step. From these tests is possible to identify the students with difficulties.
Computing systems are available with the goal of tasks manager and to illustrate concepts.	Computing systems are available with the goal of introduce or illustrate concepts, to verify hypotheses and to tasks manager.
Internet Tools are available with the goal of increase the interaction between student and lecturer.	The same that the Web page

Table 5: Page Web versus adapts of learning

2.3 Environment Implementation

The third phase describes the construction of the environment. For the implementation of the environment some specific programming language can be used (html, java, asp, etc) or some course manager platform, like WebCT [7], AulaNet [6], Learning Space [8] etc.

This phase must be accomplished by professionals of the computer science. For the implantation of the environment issues like physical space, the kind of network, connection of the personal computers, Internet access should be considered.

2.4 Ergonomic evaluation

The fourth phase refers to ergonomic evaluation. In this phase some issues should be observed for a better integration of media: links; visualisation form and the freedom for environment navigation. During this evaluation phase will be observed:

Referred to the navigation:
Is there some facility in the navigation?
Do they have a navigation map?
Are the buttons well defined and easily identified?
Is there some freedom degree in input/output of the pages?
Does it possess menu of commands?
Referred to the Legibility:
Are the colours appropriated ?
Is the size of the illustrations and of the sources are appropriated?
Is the interface design well done?
Referred to the media use:
Does has in the user interface multimedia resources, animation, graphs and illustrations?
Is there integration among the media?
Is there speed of system answers fast?

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Referred to the user help:
Is there access for the helps? (for instance, contextual, index or hypertexts type)
Referred to the printing:
Can the illustrations be printed?
Can the content be printed?

Table 6: Ergonomic criterions

2.5 Pedagogic evaluation

The fifth phase refers to pedagogic evaluation, which should be compatible with the pedagogic proposal defined in phase 1. This phase should be made preferentially by professionals of the education sciences and of the cognitive psychology, qualified to evaluate the pedagogical functions that the software can reach. Given the learning channels that can be wakened up, finally a series of elements should be questioned carefully. The evaluation should take into account the following elements:

Content
is it coherent with the target audience?
is the sequence coherent?
Does it stimulate several learning forms?
Interdisciplinary (software allows research)
Goal
Coherent with the target public?
Coherent with the curriculum ?
Is the Language adapted the public?
How are mistakes treated?
Research
Reflection
Direct Answer
Construction of the answer by the student
Is the software motivating for the student?
The software is self-didactic or does it need the the teacher's intervention?
The program can be used in several situations in class (individual, small or big groups)?

Table 7: Requirements for Pedagogic Evaluation

2.6 Usability evaluation

Sixth and last phase refers to evaluation of the environment with the students. In this phase validation activities and pilot tests with the students (preferably with students that are not of the regular in the course). The goal is to detect the satisfaction degree, motivation and difficulties in the use of the environment as well as the offer of support mediations. This phase is of extreme importance to give feedback to the pedagogical and technical team that designed the environment and to suggest modifications and updating for future versions.

3 Final considerations

In the study of the requirements for the creation of learning environments that use integrated multimedia can be noticed the need of organisation previous structuring of the activities, otherwise the learning process can be harmed.

As final consideration, the importance of the teacher's paper is stood out as mediator of this teaching-learning process, seeking to create attitudes of collaboration, to stimulate the student's reasoning, to intermediate the learning process, regulating the interaction and investigating the cognitive conflicts that take the student to question your own thought.

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A Web-Based Learning Quiz Server

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A kind of web-based CAI server system called WebQS is reported. WebQS has been developed in order to support teachers to make students interested in reviewing materials they were taught. WebQS stores quiz materials sent from teachers and then sends to students quiz pages constructed from the quiz materials. Teachers help students learn by means of not only answering quiz questions but the WebQP also corrects the answers followed by a written explanation for the students to read.

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A dynamic menu delivery system and distribution system for user content

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We announce the following two technologies to create a system capable of providing services tailored to each customer, as well as a system for simplifying the image upload process. First is our Dynamic menu delivery system. Our image viewer software called FinePixViewer displays various service menus related to images. Through the online user registration, the menu server collects the user profiles, manages the menu information for each service, and sends menus appropriate for each user to FinePixViewer. As the result, service providers can control to send their own menus to their desirable customers. Next is our AUP (Application Upload Protocol) technology as the core of the distribution system for user images. AUP is the protocol for seamless uploading of images stored on user computers to web services. By incorporating the AUP module into their web services, service providers can create web sites that readily accept images uploaded from FinePixViewer.

Importance Of Sociopersonal Variables In Computer Studies

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Nearly all human behaviour is influenced by both cognitive and the non-cognitive aspects of a person. In line with this idea, a computer literacy course is expected to exploit both cognitive and non-cognitive domains. The Faculty of Education made computer studies compulsory for all first year students in 2000. As the course progressed many students wanted to drop out of the course, the main excuse being that there was too much work involved in the course. Considering the deprived academic background of most of the students who took the course, the researcher felt that factors other than the one mostly cited could also contribute to the violent apprehension for the computer literacy course. Meece (1981) identified six possible dimensions of anxiety: dislike, lack of confidence, discomfort, worry, fear and dread, and confusion/frustration. Wigfield & Meece (1988) further on reduced the six possible dimensions of anxiety to two main factors: negative affective reactions (fear, dread, nervousness) and worry (cognitive concerns). The Wigfield & Meece (1988) Anxiety Scale was administered to a sample of first year Faculty of Education Computer studies students (n=130) and correlated its measures with their performance on the achievement test in computer studies constructed by the course tutor. The result of the research study suggested that attitude towards the computer studies course, anxiety, self-confidence in learning computer course, attribution patterns, task oriented motivation, experiential background and personality types were the variables which influence learning of the computer studies course. The first year computer studies tutor should be aware of these variables and the characters of their relationships to performance in basic computer course, and he should make effort to create lectures conducive to learning.

The blended e-learning imperative: Strategy and technology that enables collaboration and interaction in distributed e-learning.

Abstract:
Learners, more aware than ever of the importance of acquiring new knowledge, are demanding robust delivery solutions that are more effective and time-efficient. Given this situation institutions must take a closer look at e-learning as a blend of educational experiences, new technologies, and delivery via the Internet or private intranets.

Problem:

The phenomenal growth of e-learning we are experiencing today is fueled by several factors, among them: (1) increasingly reliable, scalable, and affordable telecom networks, (2) a growing movement in business, industry, government, healthcare, and education to unify global corporate cultures and standardize employee education using an on-demand, anytime/anywhere model, and (3) a growing industry trend to attract and retrain consumers with value-added services like eKnowledge databanks for sharing information and e-learning degrees supported by an extended point-of-delivery.

The e-learning capacity and the e-learning offerings available from institutions and consortia will be even more critical as the war for talent drives more learners to upgrade skills and migrate to new job markets. More specifically, institutions will need to change and revisit their learning vision because distributed e-learning will be required for future success.

Additionally, networks are maturing and capable of carrying new mission critical applications that maximize existing equipment and bandwidth and provide the proper infrastructure for the desired learning outcome. One key to success is delivering rich media over existing networks via satellite or fiber optics, videoconferencing (ISDN), 128K Intranet connections and Uni-cast or Multi-cast solutions.

Optimizing the investment in an e-learning environment is critical for successful integration with existing programs. Institutions and organizations that implement a blended e-learning solution must consider how people, processes, and technologies are affected.

Innovative solutions demand speed and agility. -- Institutions will need to substantially increase the distance and pace at which their delivery capabilities grow; people must be learning/sharing knowledge all the time. Historically, institutions delivered a variety of content through instructor-led, self-study, and sometimes computer-based methods. However, learning is a continuous process resulting in increased capability, for both the individual and organization. When learning takes place, a person can do something they were not able to *do* before, *think* in a new way, *act* differently. Nevertheless, providing instruction, no matter how good, does not guarantee that learning will happen. To enhance capabilities, institutions must think beyond classes, events and activities, and broaden their focus to include the whole context of learning - training, coaching/mentoring, performance support tools, knowledge sharing, hands-on learning experiences, etc. Ultimately, people want to gain new knowledge and feel empowered to apply and share what they've learned.

Implications:

Connectivity. Learning delivery involves key strategic actions to increase ways to connect people to each other and to learning, make a denser web/network, facilitate learning through technology and non-technology-based methods. Connectivity refers to a variety of linkages, relationships, channels that result in easier access to knowledge and others' learning; more interactive, learner-focused development opportunities; and enhanced knowledge sharing and coaching. All can enable learning any time, any place, anyway. Institutions need to significantly enhance e-learning capabilities with these connectivity variables. This means using web-delivered content, multimedia courses, real time video and audio collaboration, and virtual-reality/simulations to offer much more varied learning experience, in a more timely manner - on demand, with less time and place restraints. In the New Economy, accessing the right information at the right time (without hassle), and understanding what needs to be accessed/learned, are two necessary requirements for success. Imagine an integrated system which allows learners to assess their developmental needs, identify learning options to meet those needs, and gain immediate access to learning opportunities (through online course registration and distance learning, collaboration, knowledge sharing forums - internal and external, etc.). These integrated systems should also build in feedback loops to keep information flowing and maximize learning transfer.

Resources. Providing resources involves key strategic actions focused on people, tools and processes that support learning. Making the right resources – people, tools and processes - available is critical to creating an environment that fosters growth and motivates talented people to excel. To enhance resources in an e-learning environment, institutions must champion and stimulate coaching and mentoring. Today, helping learners acquire and develop the specific competencies required for success is necessary, but not sufficient. e-Learners need mentors who help guide their personal and professional development. This means expanding curriculum to facilitate learning in areas such as career management, health/fitness, personal and financial planning, and technology.

Alliances. Forming alliances involves key strategic actions focused on building relationships and partnerships that increase an organization's ability to facilitate e-learning. Institutions must form and strengthen strategic partnerships, rather than attempting to do it all alone.

Broker leading edge e-learning solutions. Given the diversity of learning needs in our global society, and the pace of change, it is impossible to develop and deliver all the right learning options internally. Instead, institutions must also broker leading edge learning solutions. Strategic alliances with learning product vendors and external faculty, for example, can complement existing learning design/delivery capability.

Convene global e-learning forums. This means bringing together the best and brightest minds (internal and external) to tackle e-learning issues, forming strong links with other organizations to document/share best practices, and establish strong leadership in e-learning through sponsorship of e-learning forums.

Expand the e-learning community to cross the entire value chain. Making some e-learning opportunities available to suppliers, employers, business partners, and learner families will allow institutions to further demonstrate their commitment to being partners in success - on a professional and personal level.

Lead the development of e-learning in the New Economy. Institutions must set the direction for the field of e-learning by forming alliances necessary to support leading edge research and development efforts.

Relevance:

Our experience has taught us that it is important to consider the following integration requirements when defining e-learning objectives:

- *Sufficient financial resources:* A business case must provide leadership with the arguments they need to obtain a substantial budget.
- *Access to a computer for all people involved*
- *An e-learning environment* that is compatible with the needs of the participants and the subject matter
- *A culture* that encourages the implementation of an e-learning solution
- *A realistic timeframe.* Not all e-learning fits a semester schedule and not all e-learning requires simultaneous start and stop dates.
- *Interactivity and accessibility* that are compatible with technical requirements and new technologies.
- *Enough resources* to provide the necessary support through help functions, coaching, and mentoring.
- *A balance* between e-learning and conventional instruction methods.

A Characterization Study of World Wide Web References in Korea: Analysis and Caching Implications

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Abstract: In this paper, we present a characterization study of World Wide Web references in Korea. Our study focuses on the contents analysis of Web references to exploit the analysis results in the contents caching. The analysis consists of three parts: Web document based analysis, Web server based analysis, and international link based analysis. In each part of the analysis, we present the distribution and top ranking subjects of references, and show the areas of interests that are frequently referenced by the Web users in Korea. Finally, we present how the analysis results can be applied to the contents caching.

Introduction

Due to the recent popularity of the World Wide Web over the world, the Web has become one of the most important communication channels for human societies in Korea. In this paper, we present a comprehensive analysis of the Web reference behaviors in the Korean Education Network (KREN), which is one of the main Internet service networks in Korea. There have already been a number of workload characterization studies for Web references. Most of these studies have focused on the formal analysis of workload characteristics. This paper, however, presents a characterization study focused on the contents analysis of Web references rather than the external analysis of workload characteristics. We use the proxy server logs at KREN to characterize the Web reference behaviors in Korea. We first present the ranking and distribution of Web documents and show the characteristics of popular Web documents. Then, the same analysis is done for Web server ranking and distribution to show the characteristics of popular Web sites. Finally, we present the usage of international links of KREN and analyze the characteristics of international Web accesses. The purpose of this paper is to present a workload characterization study of the Web references in Korea and show the areas of interests that are frequently referenced through the Web. This can eventually be applied to the contents caching of popular Web information, which plays an important role in relieving the problem of network congestion and access latency on the Web.

Analysis of Web References at KREN

KREN is the Internet service network for universities, schools, and educational organizations in Korea. The root of KREN is located at Seoul National University and downlinks are connected with other universities (45Mbps) and 140 regional centers in Korea. The root of KREN is connected with other top links in Korea: the National Computerization Agency (155Mbps), DACOM (155Mbps), Korea Telecom (90Mbps), ThruNet (100Mbps), Nowcom (45Mbps), etc. International links of KREN are connected with Sprint in the US (45Mbps) and TeleGlobe in Canada (45Mbps).

We use the proxy server logs of KREN to analyze the Web reference behaviors. Proxy servers act as agents on behalf of clients to send HTTP requests to Web servers and are often used to manage the local copies of Web

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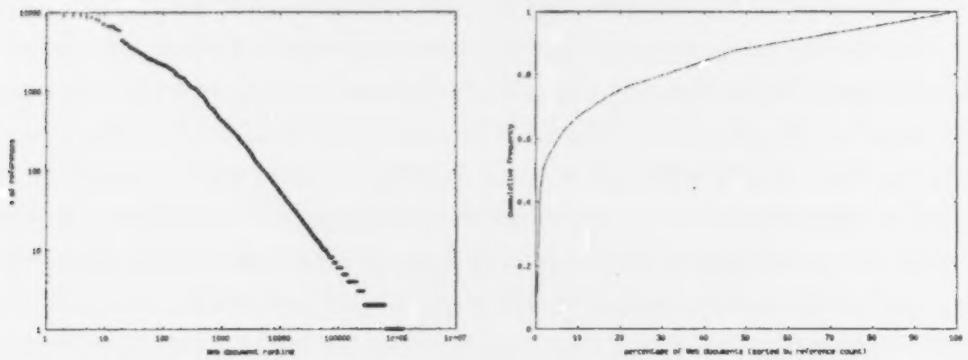
Table 1: Characteristics of the KREN proxy log used.

Total Period	6 days
Total Requests	5,704,851
Total distinct Web documents	1,308,730
Total distinct Web servers	988,036

Web Document Based Analysis

Our first analysis focuses on the frequency of reference for different Web documents. Clearly, not all Web documents are equally popular. (Fig. 1a) shows the number of times that a Web document has been referenced versus the ranking of the document, where ranking 1 is the most frequently referenced document. Note that both axes in the figure are in log scale. The curve in the figure shows that references are excessively biased to some hot documents. The curve is almost a straight line, which means that the reference frequency of the i-th popular document (i.e., ranking i) is proportional to $1/i^b$, where b is the slope of the line. This type of distribution is called a Zipf-like distribution. In (Fig. 1b), we illustrate the cumulative frequency of references versus the fraction of the total Web documents referenced. Note that the Web documents shown in the x-axis are sorted into a decreasing order based on the reference counts. The figure shows that 10% of the distinct documents are responsible for about 70% of all references and 30% of documents are responsible for 80% of all references. This also shows the evidence for the skewed popularity of Web documents.

The next step in our analysis is to classify Web documents by URL type. Classification is based on the suffix used in the URL (for example, GIF, HTML, CGI, MPG, etc). (Tab. 2) shows the distribution of URL types. As shown in the table, 75.2% of the total Web references are made to image files such as GIF and JPG. This is because Web pages often contain many image files such as banners, logos, icons, and buttons. Since these images are often small, the total sizes of the images are only 48.4% of the total object sizes. HTML documents are responsible for 13.6% of the total references and 8.3% of the total sizes. Multimedia data such as audio and video are responsible for only 0.3% of the total reference counts, but for 11.3% of the total sizes. This implies that even though multimedia data are not frequently referenced via the Web when compared with other data types, the size of the multimedia data accounts for quite a large portion in Internet traffic.



(a) Reference frequency vs. document ranking. (b) Cumulative distribution of Web documents.

Figure 1: Distribution of Web documents.

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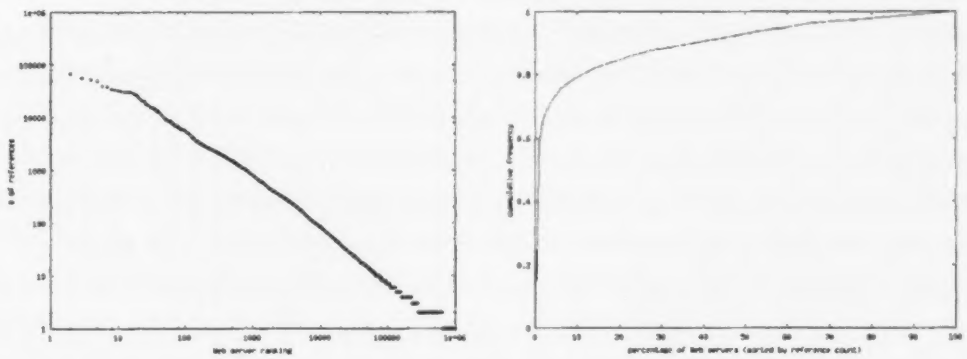
Table 2: Distribution of URL types.

Data type	Total count	Total Mbyte
Image	2627982 (75.2%)	14134.1 (48.4%)
HTML	475182 (13.6%)	2404.4 (8.3%)
Application	24925 (0.7%)	1942.2 (6.6%)
Multimedia	8700 (0.3%)	3290.2 (11.3%)
Others	357659 (10.2%)	7433.3 (25.4%)

We examine the top 50 URLs in KREN proxy logs. There are many URLs which belong to the same Web server. This is because the distribution of Web servers is also heavily skewed. (Detailed discussion on Web server distributions will be provided in the next subsection.) The most parts of the top 50 URLs are GIF files (38 out of the top 50 URLs). There are three CGIs, three ASPs, and only two HTMLs. The two HTMLs are the homepage of Netscape, and the Simmany site, which is one of the most popular search engine sites in Korea. The Netscape site is frequently referenced because the Netscape Web browser sets the default Web page as the Netscape site.

Web Server Based Analysis

From the Web documents based analysis, we showed that references for Web documents are excessively biased to some hot documents, which can be characterized as a Zipf-like distribution. In this subsection, we present the same analysis on Web servers. Since Web documents are formatted with hyperlink structures, the origins of skewed popularity may be not only human-originated preferences, but also structure-based effects. For example, the main page of a Web server can be frequently referenced while the leaf page of the same server may rarely be referenced due to the different arrangement of hyperlink structures. However, this factor is less influential in the case of Web servers, and hence we can see the human-originated reference behaviors more accurately by server-based analysis. (Fig. 2a) shows the number of times that a Web server has been referenced versus the ranking of the server. Like the Web document case, references are excessively biased to some hot servers. The distribution is again characterized as a Zipf-like distribution. This implies that most of the skewed references are originated from the human preferences and not from the structural effect of Web formats. In (Fig. 2b), we illustrate the cumulative frequency of references versus the fraction of the total Web servers referenced. The figure shows that 10% of the Web servers are responsible for 80% of all references and 30% of servers for 90% of all references. This again shows the evidence for human preferences for some popular Web sites.



(a) Reference frequency vs. server ranking. (b) Cumulative distribution of Web servers.

Figure 2: Distribution of Web servers.

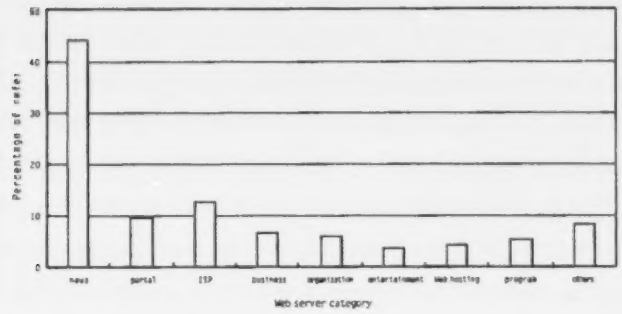


Figure 3: Percentage of references made to each group of sites.

We visited the top 100 popular sites and classified into nine groups based on the contents provided by the sites; *news*, *portal*, *ISP*, *business*, *organization*, *entertainment*, *Web hosting*, *program*, and *others*. Each group is defined as follows:

- *news*: daily news sites, newspaper homepages, and homepages of broadcasting company,
- *portal*: portal sites and search engine sites,
- *ISP*: Internet Service Providers and online service sites,
- *business*: servers of companies, e-businesses, and advertisements,
- *organization*: nonprofit corporation and universities,
- *entertainment*: sites for entertainment such as sports, game, and adult,
- *Web hosting*: Web hosting sites,
- *program*: homepages for computer program and program download sites, and
- *others*: unknown or vanished sites.

(Fig. 3) shows the percentage of references made to each group of sites. The figure shows that *news* sites are responsible for the majority of references (44% of the total references), and all of the other categories are responsible for less than 10% of the total references except for the *ISP* (12.5%). There are six *news* sites out of the top 10 sites, including Joongang (ranking 1), Chosun (ranking 2), and Donga (ranking 5) which are three major newspaper publishing companies in Korea. From this result, we can conclude that *news* is the most frequently referenced information through the Internet by KREN users.

International Link Based Analysis

In this subsection, we analyze the usage of international links of KREN. The purpose of this study is to extract some peculiarities of international references. As explained previously, the international link of KREN is connected with Sprint in the United States (45Mbps).

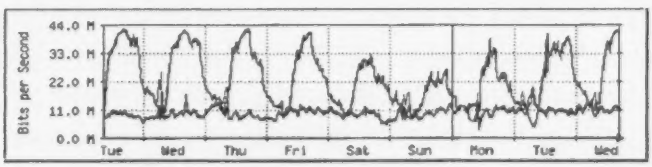


Figure 4: Usage of international links.

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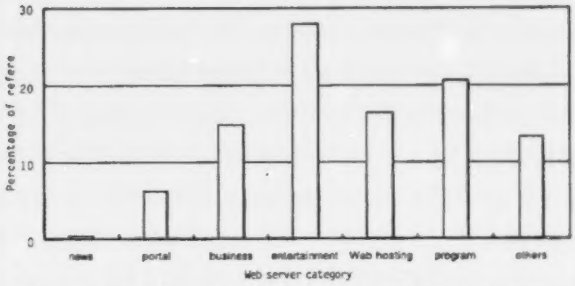

Figure 5: Percentage of international references made to each group of sites.

(Fig. 4) shows the usage of the link for a week. The curve in the upper position represents the usage of the incoming link (from Sprint to KREN) and the curve in the lower position represents the usage of the outgoing link (from KREN to Sprint). As shown in the figure, the usage of the incoming link is larger than that of the outgoing link. Note that the incoming part of the international link has often been the bottleneck point of KREN and has recently been extended several times to relieve network congestion. The usage of the incoming link increases and decreases periodically and the cycle is one day. This is due to the human life cycle of the 24-hour pattern. The peak time is during the office hours (12:00-15:00) and the idle time is the midnight or dawn (3:00-6:00).

To see the reference behaviors in the international lnk, we gathered all the HTTP data passing the international link using a transparent proxy server. We examine the top 100 international sites that are most frequently referenced through the international link by KREN users. We classified these sites into categories as done in the previous subsection. (Fig. 5) shows the percentage of references made to each group of sites. The figure is obviously different from the case when domestic references are included. *Entertainment* sites are responsible for almost 30% of the total international references. Specifically, *adult* sites occupy 90% of the total entertainment sites and 38 out of the top 100 international sites are adult sites. Note that no domestic adult site was found in the top 100 servers in the previous subsection. We think that this is because adult sites in Korea are controlled and regulated by Korean domestic laws. *Program* sites are responsible for more than 20% of the total international references. These sites include the homepages of Microsoft, Netscape, Realplayer, etc. One major reason for this phenomenon is that most Web browsers and PC softwares often set the program to connect their download sites automatically. Note that the rankings of the Microsoft and Netscape in the top 100 international sites are 1 and 6, respectively. Another interesting result is that *news* sites occupy only 0.5% of international references (only one site, CNN exists in the top 100 international sites). This implies that most of the *news* sites visited by KREN users are domestic sites, that are written in Korean.

Caching Implications

In this section, we present how the analysis results can be applied to the contents caching. Web users can benefit from this contents caching in terms of latency reduction because a more narrow Internet access is possible. Moreover, contents caching could save network bandwidth and reduce the load of Web servers.

Since the majority of references are made to domestic *news* sites, this news information should be prefetched or pushed into the cache server to be efficiently accessed. International Web documents can be prefetched at midnight when the international link is free. *Program* sites can be mirrored to domestic local sites to save the network bandwidth. *Adult* sites can also be mirrored since they are the majority of international references. It may be helpful to prioritize the contents to be cached based on their relative importance. For example, we can give *news* sites higher priorities than *adult* sites.

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Related Works

To date, there have been a number of efforts that attempt to characterize the workload of Web references. The characterization can be done from various viewpoints such as from the Web client side and the Web server side.

In the case of Web server side studies, Arlitt and Williamson present a workload characterization study for Internet Web servers (Arlitt 96). They show some invariants from their workload characterization, such as the successive connection rate, file type distributions, file size distribution, etc. Almeida et al. propose models for temporal locality and spatial locality of reference in streams of requests arriving at Web servers (Almeida 96). They show that temporal locality can be characterized by the marginal distribution of the stack distance model and spatial locality in a reference stream can be characterized using the notion of self-similarity. Some studies present the workload characteristics of specific Web servers. (Arlitt 00) show a workload characterization study of the 1998 world cup Web site. (Menasce 99) characterize the workload of E-commerce sites.

In the case of Web client side studies, Nagarajan and Raghavan characterize the behavior of Web clients and design a prefetching engine that exploits the characterization (Nagarajan 00). Web proxy server side analysis shows more generalized characteristics of the client side behaviors. Breslau et al. present the distributions of Web request streams seen at proxy servers (Breslau 99). They show that the Web document request distribution seen by Web proxy caches follows a Zipf-like distribution. Jin and Bestavros show that temporal locality of Web reference streams seen at proxy servers emerges from two sources, i.e., the long-term popularity of Web documents and the short-term temporal correlations of references (Jin 00). Pitkow summarizes the Web workload characterizations from three points of view; the client side, the Web server side, and the proxy server side (Pitkow 98).

Conclusion

In this paper, we presented a characterization study of Web reference behaviors in the Korean Education Network, specifically focused on the contents analysis. From this analysis, we showed the areas of interests that are frequently referenced by Web users in Korea. We also presented how the analysis results can be applied to the contents caching of Web objects. We believe that the characterization and analysis study presented in this paper can also be helpful to government policy makers and e-business people, as well as researchers related to caching technologies.

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Web-Based Instructional Modules Designed To Support Fundamental Math Concepts In Entry Level College Mathematics: Their Effects, Characteristics Of Successful Learners, And Effective Learning Strategies

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Abstract: The first goal of this study was to examine the impact of nine Web-based learning modules on learning as measured on both online module quizzes and in-class exams. The modules were designed to support fundamental concepts in entry-level college mathematics courses. The second and third goals of this study were to determine the (a) learner characteristics and (b) strategies that affect student performance on the nine web-based learning modules. Findings indicated that students who scored above 80% on the module quizzes also did better on in-class exams. Those who were self-motivated, focused and self-disciplined had greater success in the online module environment than students who participated haphazardly or erratically in the modules. We conclude that Web-based modules support learning when used systematically by learners and that such modules extend the reach of the classroom teacher and reinforce classroom instruction.

Objectives

Although web-based computer-assisted instruction is becoming openly accepted and used, there is little quantifiable data as to its effectiveness in helping students become successful learners. Given the money being allocated and commitments being made to the use of technology in homes and schools, it is incumbent upon educators to demonstrate that student use of technology can result in adequate or above average student success. In addition, researchers need to identify those learner characteristics and behaviors that foster quality learning and development in technologically-based environments so that educators can provide differential instruction to their students.

This study examined the impact of nine web-based learning modules, designed to support fundamental concepts in entry-level college mathematics courses, on learning as measured on both online module quizzes and in-class exams in two university level mathematics courses. Concepts were presented in class and then students were expected to interact with the online modules to expand and clarify their in-class learning. The second and third goals of this study were to determine the learner characteristics and strategies that affected student performance on the

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nine web-based learning modules as well as course test scores. Specifically, answers to the following questions were sought.

1. How does the use of the nine web-based learning modules designed to support fundamental concepts in entry-level college mathematics courses impact student success on in-class tests and quizzes?
2. What are some of the characteristics of learners who exhibit satisfactory performance on both the nine web-based learning modules and in-class tests and quizzes?
3. What are some of the learning strategies of learners who exhibit satisfactory performance on both the nine web-based learning modules and in-class tests and quizzes?
4. What are some of the characteristics of learners who exhibit unsatisfactory performance on both the nine web-based learning modules and in-class tests and quizzes?
5. What are some of the learning strategies of learners who exhibit unsatisfactory performance on both the nine web-based learning modules and in-class tests and quizzes?

Theoretical Framework

The explosion of available online educational materials and increased access to technology and the Internet in classrooms across the country has shifted educators' attentions to areas such as computer-assisted and online learning (Anglin & Morrison, 2000; Brown, 2000a; Brown, 2000b; Francek, 2000; Kessler, Rosenblad, & Shepard, 1999; Liaw & Huang, 2000; Levinson & Surratt, 2000; Lyall & McNamara, 2000; Mioduser, Nachmias & Lahav, 2000; Norman, 2000; Owston, 1997; Reiber, 1992; Spodick, 1995; Starr, 1996; Wagschal, 1998). With the ability to easily access online and interactive learning materials from any location via an Internet connection, parents, educators, and legislators are seeing the Internet as a cost effective way of leveling the learning environment for students across the country (Francek, 2000; Kessler, Rosenblad, & Shepard, 1999), as well as tailoring the learning environment for each learner (Haury, 1999; Keup 1998; MacKnight, 1998; Roth, 1999; Svetcov, 2000).

Researchers and practitioners alike have expressed concern about whether students can learn as well in a web-based environment as they do in a face-to-face environment (Bonk & Dennen, 1999; Diaz & Cartnal, 1999; Leasure, Davis & Thievon, 2000; Sankaran, Sankaran & Bui, 2000; Zielinski, 2000). Studies have shown that learning can actually be enhanced using the World Wide Web. Ross and Schultz (1999) and Sankaran, Sankaran and Bui (2000) found that the use of innovative Web applications could address a wide range of diverse learning styles. Online conferencing gives students who might be too shy to speak up in a face-to-face setting a chance to voice their opinions and participate in discussions they might not normally participate in (Bonk & Dennen, 1999). Instead of being tied to a traditional classroom schedule, students are able to participate in Webb courses at a time and in a place that works best for them (Leasure, Davis & Thievon, 2000).

Methodology

This study examines the impact of nine JAVA-based computer modules in mathematics on learning as measured by quizzes and in-class exams in core curriculum, university level, finite mathematics courses. The study also looks at learner characteristics, (e.g., background, course goals, etc.) and at strategies employed by students while working on the modules. This is a mixed methods study in that it features both qualitative and quantitative methods for data collection and analysis.

Participants

Subjects. The participants in this study included 147 students enrolled in two fall semester sections of MATH 141(Business Mathematics I) and 191 students in two fall semester sections of MATH 166 (Topics in Contemporary Mathematics II). The total sample size for the study was 338.

Courses. One of the selected MATH 141 classes will have access to the nine web-based instructional modules although participation will be optional for these students. The second Math 141 class will not have access to the

modules and will be used as a control group. For the MATH 166 courses, students will be required to complete the nine web-based instructional modules over the course of the semester, (approximately one per week). The four classes will create a continuum of module use going from nonuse to partial use to complete use and interaction. These classes were chosen for the study because of the close alignment of curriculum goals and coursework with the scope and content of the modules. Although the two courses are designed for different populations, the content of both courses is virtually identical. Concepts, order in which material is presented, and amount of class time spent on each topic are the same. In addition, the instructors for each of the classes using the modules is a developer of the system, hence, they should be able to seamlessly incorporate the modules into the class curriculum.

Procedures

Access. Students gained access to the modules over the Internet. All students were required, as a part of their coursework in mathematics, to obtain a TAMU student computer access account. Modules were accessed through a secure password protected account. This means that only students enrolled in the specified sections were able to login to the modules through the campus open access computer labs or through personnel PCs. The math modules run on any operating system platform using a JAVA enabled browser (e.g. Netscape or Internet Explorer).

Data Sources. Data Sources included (a) a demographic survey, (b) nine web-based instructional module quizzes, (c) three in-class quizzes, (d) three in-class, paper based quiz surveys, (e) an in-class final exam, (f) an exit survey, and (g) face-to-face interviews.

At the beginning of the semester, students completed an online demographic survey ascertaining the gender, age, course expectations, and study habits of each participant. By being in a proctored room, the researcher assured that each student was completing the tests themselves without the help of study aids, calculators, or outside assistance or help. The demographic survey information was used to make sure that the four classes being studied were similar in makeup and overall ability.

During the course of the semester, individual module login data, and quiz performance data on the nine web-based instructional modules were gathered and recorded into a secure database. Data related to the use of the modules— (a) number of attempts to take each quiz, (b) first score on each module quiz, (c) last score on each module quiz, and (d) highest score on each module quiz for each student, were gathered and sent to asecure database.

As a normal part of expected course work, students completed three in-class quizzes. The quizzes took place approximately once a month, were created by each individual instructor and consisted of both multiple choice and workout problems.

Students also were asked to complete a survey each time they took an in-class quiz, establishing study habits and student expectations. The survey specifically looked at how students used the modules as a part of their study and preparation for each major exam as well as their judgement of module effectiveness for facilitating their primary learning goals.

At the end of the semester students took an in-class final exam. While all instructors' exams were unique, they all contained a sampling of 4 or 5 identical questions aligned with the concepts covered both in text and in the online applets.

All participating students will also be asked to complete an exit survey at the end of the semester, which will be given at the end of their final exam or during the study session just prior to their final exam. In addition to the eleven questions that they have been ranking on a Likert scale following each of the three in-class quizzes, this survey will also include fourteen additional open-ended questions. These additional questions will be optional for the students and will focus on the strategies students used during the course of the semester to complete the online modules.

During the final exam, participants will be asked to complete one last survey. This survey well again ask students to identify their gender and class ranking as well their current and expected grades for the course. Students will then be asked to rank their feelings about the modules on a 1 to 100 point Likert Scale.

Interviews at the end of the semester will be used to add description and validity to the information gathered through the quiz surveys. Following the third in-class quiz, students' grades on module quizzes one through eight and grades on in-class quizzes one through three will be analyzed in order to place students within a 4

by 4 matrix. Three students from each matrix category will be randomly chosen for an interview. This should provide a list of twelve randomly selected students. Interviews will be conducted between the third exam and the end of the semester.

Data Analyses

By creating a mixed methods study, an attempt was made to not only to verify that there was some learning effect but also to identify some learner characteristics and strategies, which could interact with the modules to effect learning. The quantitative data, which included the scores on the nine web-based instructional module quizzes, scores three in-class quizzes, and the score on the in-class final exam, was the most effect way to look for a relationship between student achievement and the modules and to answer question one. By correlating scores on the quizzes included as a part of each of the nine-based modules and scores on the in-class exams and the final exam, as well as the final course grade a re lationship should become evident.

Module quiz scores, in-class exam scores, and final course grades were used to answer question one, how did the use of the nine web-based learning modules designed to support fundamental concepts in entry-level college mathematics courses impact student success on in-class tests and quizzes. Module quiz scores, in-class exam scores and final course grades were analyzed to determine if modules had had an effect on learning in mathematics. Highest module quiz grades for each module quiz were averaged and then compared to average exam scores and the final course grade across groups: Module Use Group, Optional Module Use Group and the Control Group. The correlation coefficient is a direct measure of the relationship between variables. To measure the association between the modules, exam scores and final course grades, a Pearson product-moment correlation was run. To further compare the modules, exam scores and final course grades a Multivariate Analysis of Variance (MANOVA) was run. Scores on exams and the final course grade are the two dependent variables, and our hypotheses are that each will be positively affected by module use. When a statistical significance was found then Tukey's Post Hoc Test was run. A Tukey's Post Hoc Test will show which comparisons are significant when all possible pair wise comparisons are carried out.

The qualitative date which included the demographic survey results, the three in-class, paper based quiz survey results, the exit survey results, and the twelve face-to-face interviews, most effectively looked for learner characteristics and strategies of students who use the web-based modules. By using the survey information and interviewing students face-to-face, there is a chance to identify some of those learner characteristics and strategies that most effect learning with the web-based modules. The interviews and observations made during class visits and discussions with each professor should provide thick description about what is actually happening with the students during actual module use.

To answer questions two and three, what were some of the characteristics of learners who exhibited satisfactory performance on both the nine web-based learning modules and in-class tests and quizzes and what were some of the learning strategies of learners who exhibited satisfactory performance on both the nine web-based learning modules and in-class tests and quizzes, module quiz scores and learner characteristics as identified through the demographic survey were analyzed to determine if they could have had a confounding effect on learning attributed to module use. A statistical frequency was run on the demographic data and analyzed to determine differences between the groups that could have confounded effect results. While the demographic survey looked at multiple learner characteristics, variance was only found in gender, major, grade in high school algebra class, high school geometry class, student's comfort with computers and average reported web browser use. Highest module quiz grades for each module quiz were averaged and then compared across learner characteristics. To further compare the module quiz scores and the demographic variables a Multivariate Analysis of Variance (MANOVA) was run comparing highest mo dule quiz scores, final course grades and learner characteristics. If a statistical significance was found then Tukey's Post Hoc Test was run in order to determine which comparisons were significant.

Interviews, the three in-class exam surveys, the final exam survey, the post final exam survey, and average module quiz scores and the average number of module quiz attempts for each of the nine modules were analyzed in an attempt to answer questions four and five, what were some of the characteristics of learners who exhibited unsatisfactory performance on both the nine web-based learning modules and in-class tests and quizzes and what were some of the learning strategies of learners who exhibited unsatisfactory performance on both the nine web-

based learning modules and in-class tests and quizzes. Module data was analyzed to determine what learner strategies for completing the modules, in regards to the number of attempts made to complete each module quiz and the scores received on each attempted module quiz developed over the course of the semester. How much time students spent in each module, how students performed on module quizzes and how students approached module quizzes was of particular interest in establishing learner strategies in using the modules.

An analysis of the three in-class exam surveys was done to look for emerging learner strategies. Specifically, a statistical frequency was run comparing in-class survey one, two, three, and the final exam survey results. The frequencies were analyzed to determine changing trends in study habits, allotted study times, and perceived effectiveness of these activities.

A content analysis was used to identify emerging topics and themes regarding students' learning strategies described by students during interviews and on the post final exam surveys. Participants were assigned a pseudonym and a number, which corresponded their placement within the interview selection matrix. Transcripts and survey questions were analyzed and separated into meaningful units. Cards were created for each unit of meaning and each card was assigned a string of numbers. Cards were coded for card number, type of data (interview or survey), interviewee, date of interview, and interview matrix location if applicable. For example: 12.I.SS.12/02/01.1/1 would indicate that card 12, was part of an interview with Sam Spade conducted on December 2, 2001 and he was a part of the low number attempts and high module quiz grade group. This form of coding was used to create an audit trail.

Interviews and surveys provided invaluable sources of data. Themes and topics as well as supporting statements were determined by multiple sources including these interviews and post final surveys, as well as the in-class surveys and observations made throughout the duration of the study.

Results

Findings indicated that the web-based modules contributed positively to students performance in the course. Average module quiz scores, adjusted exam scores, and final course average were highly correlated. Students who scored above 80% on the module quizzes also did better on in-class exams and final course average. Based upon qualitative data, including ongoing in-class surveys and follow-up interviews we found that those who were self-motivated, focused and self-disciplined had greater success in the online module environment than students who participated haphazardly or erratically in the modules. Students who had a plan for completing the module activities and quizzes scored higher on the quizzes and in-class exams. Many students who skipped through the module activities as quickly as possible, without reading the information presented or working through the interactive activities, eventually did well on the module quizzes. These learners often made ten or more attempts at the quizzes before achieving a score of 80% or better, but they did not do as well on the in-class exams. Planning, applying the modules repetitively and thoughtfully, and consciously making connections between course activities and module activities were strategies that positively impacted module effectiveness. Based on these findings, we conclude that Web-based modules supported learning when used systematically by learners. Conversely, students who did not plan, repetitively engage in the modules, or make connections did not successfully use the modules for learning.

Significance of the Study

The Internet can be a powerful and useful tool. Education can no longer ignore the Internet's potential for the classroom and learning but neither can education abandon its need for standards and accountability. This study focuses on the connection between web-based learning modules and their impact on student success as well as identifying some of the characteristics of learners who succeed or do not succeed in this environment. The insights gained here can help to provide a basis for designing additional web-based, modular environments in which students can find learning success can be used to identify students who may require preliminary training in how to learn online. In addition, effective strategies identified in this research can be the basis of such preliminary training.

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Distance courses based on the integration between andragogic and constructivist principles using web, for permanent formation on health human resources: the proposal of Oswaldo Cruz Foundation, Brazil.

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The main proposal of this work is to present the dynamic construction and application in the Distance Courses offered by FIOCRUZ that use the web as an strategic element of contribution to form professionals related to health sectors, its fundaments, methodology of construction, assuming a transformer role, to estimulate an education that forms and reconstruct, through a didatic experience, aiming a personnel growth for the development of individual habilities to understand and feel the world, allowing the complete practice of the real citizenship.

Embedded self-assessments in Executive Education courses: Improving participant learning and perceptions of course quality

Background: We have been building online Executive Education courses for Cardean University as employees of UNext. At UNext, these courses are referred to as "Quantum" courses, to distinguish them from traditional academic courses in Cardean's online MBA program. Quantum courses provide a six to ten hour learning experience that provides information about a relevant business topic (e.g. change management, brand management, and financial statements) as well as an opportunity for learners to apply what they are learning in a relevant task. Quantum courses use many interactive techniques and "widgets" to engage and motivate students. Widgets are javascript-based XML objects that course development teams use to build common interactive instructional segments. One class of widget is the self-assessment. Self-assessments are used in some courses to provide a quick way for learners to ascertain whether they are learning anything or not. How effective are these self-assessment techniques? To date, no research (that we are aware of) has attempted to evaluate the effectiveness of any of these instructional devices in online executive education. We have been relying primarily on "good design principles" and preliminary user experience testing to guide our designs and implementations. While we do not consider this reliance on principle invalid, we have undertaken a research project designed to establish the effectiveness of embedded self-assessments.

Researching the effectiveness of using embedded self-assessments on student learning and perceptions of learning is beneficial to UNext in several aspects. First, it will help to determine if these assessments are indeed helping the students to learn and retain the content of a course. Second, as developing quantum courses is a resource intensive process, learning whether embedded self-assessments are useful to students would help in not only improving the courses, but also streamlining production to focus on course design that effectively helps students learn. Additionally, learning about how the student perceives the self-assessments is also beneficial. Even if there is no difference in learning (measured by post-assessment) between students who take courses that have self-assessments and course that do not have self-assessments, if the student perceives that they are learning more, this may be valuable in itself. Even the perception of increased learning may lead to greater learner satisfaction. In the business of e-learning, satisfied learners generally leads to satisfied customers.

Study questions: In order to learn more about the use of self-assessment questions in Quantum courses, this study answers two major questions.

1. Do embedded self-assessments affect student attitudes or perceptions about learning in a Quantum course, as measured by a survey administered after course completion?
2. Do embedded self-assessments affect student learning in a Quantum course, as measured by a multiple choice post-assessment?

Participants: Thirty participants who fit the target profile for Quantum course students will complete the study. Participants should be degreed business professionals, interested in the course topic, and familiar with using the Internet (browsing the world wide web, using email, etc.) but should not be familiar with the specific course content. Participants are asked to volunteer three to four hours of their time (in one sitting) for the study. Participants are offered small compensation for their participation, in the form of light refreshments and gift certificates to local restaurants. It is not expected that this compensation will affect the results of the study.

Context: Participants complete two courses from one Quantum course suite, "Get the Net." This Quantum suite is designed to help professionals understand, recognize, and analyze working Internet business models using information gathered on the Internet. It explains key economic principles that underlie the Internet's rapid transformation of business strategy and culture. The research team observes participants as they complete the study under one of two conditions. One condition is "Quantum course without embedded self-assessments." The other condition is "Quantum course with embedded self-assessments." Participants in both conditions are given a final attitude survey and a comprehensive (approximately twenty question) post-assessment. Quantitative analysis of the survey responses and post-assessment results, and qualitative analysis of participant debriefing transcripts is used to generate findings and recommendations.

Method: The courses chosen for the study are the first two courses in the "Get the Net" Quantum suite. The course titles are "Evolution of the Firm" and "Age of Human Capital." These courses were chosen because of an expected high level of participant interest in the topic, content that is new to the participants, and the minimal existing use of self-assessments in each course.

The research team created a set of embedded self-assessments for four of the five sections in each course. The fifth course section already includes an assessment component, and self-assessments do not "fit" the instructional purpose of the section. The team also removed the minimal amount of embedded self-assessments that existed already in the courses, taking care not to change course content or activities which demonstrate content mastery.

Participants complete the study during a single three to four hour time block in the User Experience Lab at UNext's Bloomington Development Center in Bloomington, Indiana. This lab is equipped with multiple testing stations, at which the participants will complete the study and access the online courses. Participants are briefed on the use of the testing station computers, how to access the course, and the overall topic of the study, but will not be informed of the particular study group they are in. Participants are instructed to complete each of the courses thoroughly and that their learning will be assessed after they complete the courses. One study group completes the courses without the self-assessments and the other group completes the courses with the embedded self-assessment condition applied.

All participants complete one attitude survey and one comprehensive post-assessment after completing both courses. The attitudinal survey asks the participants questions about how they feel in regards to the assessment techniques used in the course; whether or not they found them useful. They are also asked questions concerning their thoughts on the course content itself and their perceived mastery of it. The survey uses a Lickert scale for participant responses. The post-assessment serves to assess the participants' mastery of the course content for comparison between the two study groups. This assessment uses a mix of multiple choice and short essay questions.

Analysis: A comparison will be made between the survey responses between the groups of participants in each condition. Specifically, we will look for evidence of correlation between the existence of embedded self-assessments and student perception of learning and attitude toward the overall course experience. Additionally, we will look for evidence of correlation between the existence of embedded self-assessments and student achievement on the post-assessment. The post-assessments will also be analyzed to determine if one group performed better or worse than the other. A rating scale will be used to rate the essay responses and three raters will be used, the average of their ratings being calculated to determine scores.

Expected findings: We expect that the existence of embedded self-assessments will increase the student's perception of learning, and will also increase the student's learning of course content. If this expectation is upheld by the study data, this may lead to a recommendation that more embedded self-assessments be included in Quantum course suite designs. If the study finds that self-assessments do not positively influence student perception of learning or actual student learning as measured by the attitude survey and post-assessment, respectively, a recommendation will be made to reconsider the current use of self-assessments. This may lead to removal of self-assessments or the re-design of self-assessments in order to increase their effectiveness.

At the time of this proposal submission, the study design has been finalized and we are beginning to gather data. At the time of the Webnet 2001 conference, all data will be gathered, analysis will be complete, and preliminary findings will be reported.

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Navigation Objects and Facilities for Exploring Hyperworlds

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Abstract: The integration of virtual worlds is going to play an increasing role within existing web information systems and environments. Although a virtual world is a 3D information space itself, other hyperlinked 3D worlds are parts of the complete information network. In many cases the entry (view) point within one hyperlinked world has no connection with the exit location of the previous 3D world. Furthermore the navigation within the world at issue is very often bound to predefined browser features. To improve the navigation within and between web-based 3D worlds we present 3D Web elements for interactive or autonomous transportation within one world as well as traveling between hyperworlds.

Introduction

In contrast to existing 2D web information systems the third dimension provides the user with a variety of additional information in combination with extended exploration facilities. Although it is well known that the work with a 3D environment seems to be more natural and users can profit from their knowledge about the real world they could easily be lost in space. Users are familiar with desktop interfaces and the handling of hyperlinked multimedia information being aware of the difference between this kind of information network and a printed work. Concerning 3D worlds the similarity to the real world, especially the visual appearance, as well as missing details will be recognized at once, but the differences and new facilities in most cases not. It is important to realize that a virtual world might be flat, have any other form with or without boundaries or be an empty space. Moreover hyperlinked virtual worlds (hyperworlds) could form a higher logical world. Although interaction tasks like selection and transformation of objects play an important role for exploring hyperworlds [Hand, 1997; Mind, 1996] the focus of this work is on navigation task: the user is moving and looking around to get any possible information from different points of view. Without appropriate navigation possibilities, the exploration of the 3D information space will be bound to predefined browser features. Furthermore traveling between hyperworlds will be reduced to the "beam me up" from one puzzle of a higher world to another without having any connection. We present Web elements to extend exploration facilities within a single virtual world as well as to support a smooth traveling from one sub-world to another without the need of jumping. Some of these Web elements do not only realize an easy to use transportation but the change of roles. Using the markup language XML for the definition of these new Web elements and meta-structures, the integration within different kinds of web-based visualization environments based on VRML/X3D and/or Java3D will be supported.

Web Elements for Navigation

Walking or flying are the most familiar types of navigation within virtual worlds. The user is performing the navigation transporting her through the surrounding environment. In general she is presented by only using her viewpoint. A look around will not show any feet or hands or other parts of her body. Within multi-user environments a virtual role will be chosen using a 3D object, the avatar, to visually embody the user for the other participants in the joined virtual world [Martin, 1999]. If appropriate input devices are available one could not only transfer the virtual position into the virtual environment but also the real body movements [Macedonia; Rosenblum,

1998]. Although using an avatar additionally allows the user to visually perceive herself, in general this feature is not used. The concept of our new Web elements is the integration of the user's viewpoint with any 3D object to present the current user, if needed. For user transportation within a single virtual world the position and orientation of these Web elements, the navigation objects, will be manipulated. To realize the traveling between virtual worlds they are extended to a combination of several viewpoints, hyperlinks of the shared worlds and the connecting 3D object.

Navigation within one virtual world

Beside the possibility to take a role (humanoid, animal, a camera etc.) with the aim of exploring the surrounding world from different points of view, a 3D object could as well present transportation objects like vehicles, ships or perhaps an animal (Figure 1).

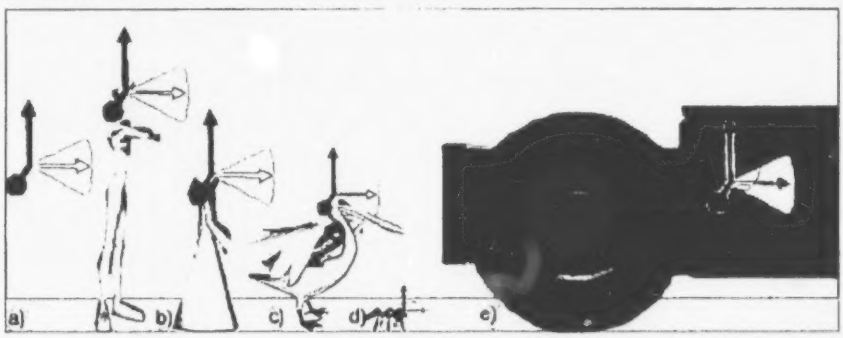

Figure 1: different 3D objects for user presentation or transportation
a) only viewpoint, b)+c) humanoids, d)+e) take animal roles, f) drive with a vehicle

Important is to split up each navigation object into appearance, position of the users viewpoint relative to the objects position and an interactive or autonomous transformation of the chosen 3D object. The complete element will be handled like any other group element (e.g. a group or transform node, having its own coordinate system).

```
<!element Navigation (Appearance, PointofView, Rules)>
```

Appearance: According to the fact, that a transportation object might represent different roles or vehicles, the desired 3D object are integrated using an *inline structure* (optional hyperlink reference). If no extra 3D object is needed only the *origin coordinate system* of this transportation object will be positioned within the higher world. Inlined objects should have the right size in contrast to the user and other objects in the virtual environment. If every 3D model is correctly specified in "meter" no further definition is needed. Otherwise the optional definition of a *bounding box* provides the overlaying application with scaling information.

```
<!element Appearance (Origin, Inline?, BoundingBox?)>
```

Viewpoint Position (point of view): For the first persons view [Barrilleaux 2000] the viewpoint will be embodied in the chosen object near a place where eyes would be found in reality (A) Figure 2) using the *initial position* transformation. This initial position is the offset for further transformations and might be used as camera position to get the visual perception of a chosen role or the highest priority point of view within a vehicle (e.g. the driver). Other points of view (second person view [Barrilleaux, 2000]) will be reached using the *additional position* transformation, e.g. to realize a ride with the presented creature (B) Figure 2) in addition a take the role.

```
<!element PointofView (InitialVP, AdditionalVP*)>
```

Navigation Rules (transformation): The navigation facilities of the new Web elements are described independent of predefined browser features. Nevertheless existing exploration facilities could be combined with the additional navigation rules or be filtered to use only a subset of the produced input information. *Autonomous* movements of any 3D object offer a lift to explore the surrounding environment without any further interaction. This *type of*

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navigation will ignore any other interaction information from browser features or the higher application besides switching viewpoints. The *semi-interactive* mode allows start and stop interactions or e.g. speed variation but no free movements. The complete *interactive* controlling (virtual driver license) manipulates the transportation object according to all available *Degrees of Freedom*. To simplify the definition of vehicle and role characteristics *predefined navigation types* provide a set of *DoF* definitions, to describe allowed movements and rotations e.g. for walking or flying. These predefined sets could be overwritten using the separate *DoF* description. Beside the possibility of controlling the movement of the chosen navigation object it might be useful to allow movements relative to the navigation object (e.g. changing the place in a bus or slide forward or backward sitting on a pelican like (B) Figure 2). The additional *boundary type* classifies this relative movement into *rigid* (no movement allowed), *limited* (e.g. external boundary like inside a room) or *free* (any relative position possible).

```
<!element Rules NavType?,PredefNavType?, DoF?, FurtherNav?, BoundaryType?)>
```

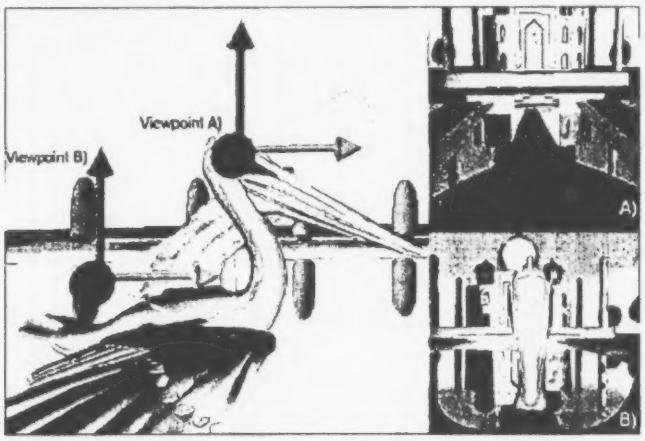

Figure 2: different viewpoints for different points of view
A) explore with the point of view of the 3D object (be a pelican),
B) explore the world, riding on the 3D object (swim with the pelican)

Every defined viewpoint within the navigation object could be handled as a camera position. We decided to take the initial viewpoint as rigid camera position, presenting the first person's point of view. All other points of view could be manipulated according to the desired application domain and exploration demands. During traveling through the current virtual world boundaries will be reached and the demand comes into being to travel to the next world.

Traveling between hyperworlds

The existing facility "beam me up" allows traveling between two worlds without any predefined pair of locations. In general an object with a hyperlink will be selected to activate the "beam me up". According to existing predefined viewpoint positions the first available will be taken as entry point. The presented Web elements for hyperworld traveling are combining viewpoints and objects/worlds with the aim to realize a connection between the entry and exit viewpoints of the participated hyperlinked worlds.

Hyper (door) link: Walking through a door is the simplest solution for hyperworld traveling. Any object with nearly no depth will be placed in both participated worlds. This door is linked with one viewpoint serving as entry and exit viewpoint according to the direction of traveling (a) Figure 3).

Hyper (tunnel) link: Three-dimensional objects with an existing boundary like a tunnel, a lift or any other form of a room will be passed through, to reach the new world. A set of viewpoints is presenting the possible entry and exit points of this object. An object entry point is equivalent to the exit point of the previous world. Leaving the object at a specified exit point will result in being transformed to the entry viewpoint of the next world (b)+c) Figure 3).

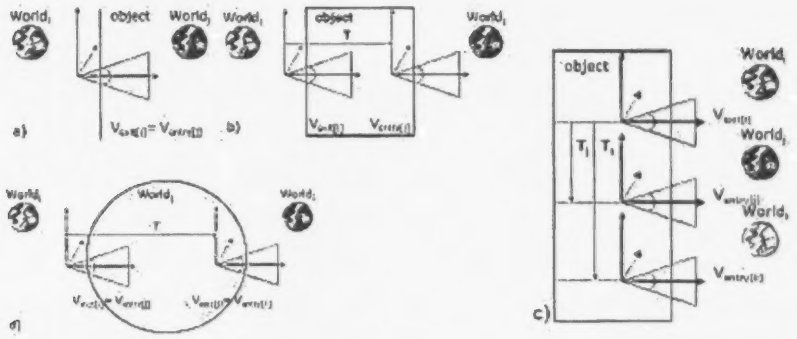

Figure 3: a) hyper (door) link – using an object with nearly no depth and one viewpoint, b) hyper (tunnel) link – simple version combines a room with entry and exit viewpoint, c) complex room objects with several entry/exit viewpoints and transformations between them, d) a complete world with specified entry and exit viewpoints

Hyper (world) link: If complex room objects will be defined as separate worlds, they need an entry and exit viewpoint being connected with suitable viewpoints in the shared worlds (d) Figure 3). Leaving the $world_i$ at the exit viewpoint means an entry into the in between (hyper)$world_j$. The user could explore this world or is transformed automatically to the exit viewpoint being transferred directly to the entry point of the destination ($world_k$).

Every exit viewpoint will be the entry viewpoint if the user is going to travel in the reverse direction. According to the predefined viewpoint orientation a reverse movement is needed. Going backward may be uncomfortable and unnatural. The problem will be solved taking only the entry and exit position and combine it with the last navigation direction and/ or speed. If the exit viewpoint had been reached using a navigation Web element being combined with a 3D object, this element has to be transferred to the other world too, to maintain a chosen role or transportation vehicle.

New Facilities using Navigation Objects

Predefined browser features could be used, but will be filtered according to the allowed navigation rules. Every 3D world could be extended with hyperworld linking or with additional transportation facilities. The existing web-based visualization environment is still using its X3D repository. Without any extensions, the new navigation API could import any 3D object with dynamic effects, transform it according to the new navigation description and export existing 3D formats (X3D or VRML97) for indirect usage (Figure 4 a)).

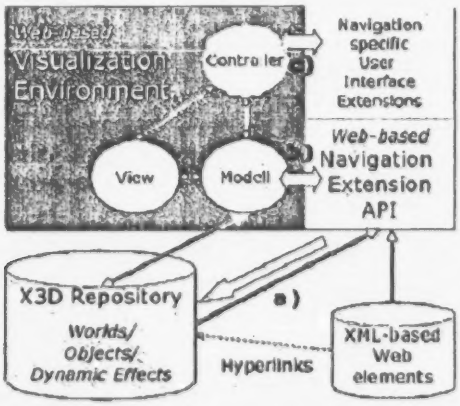

Figure 4: new navigation API with X3D export (a), methods for updating the visualization model (b) and user interface extensions (c)

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The new API allows the direct manipulation of the visualization model for the integration of the new Web elements with the complete functionality (Figure 4 b)). Using new user interface components (further input devices or virtual handles) the navigation possibilities will be improved (Figure 4 c)).

Within the following example a dynamic object is taken as transportation object. It is not important, whether the dynamic effect is integrated using the possibility of sensors, routing and interpolation lists [www.web3D.org, 2000] or whether the transformation information is updated using Java or JavaScript [java.sun.com, 2001]. This description is used for the navigation extension combining the object with a viewpoint.

```
//Original
<X3D>…
  <Transform
   DEF= 'desired-transportation
         -object'
   translation='x y z'…>
      <Inline URL='"object x.wrl"'…/>
  </Transform>…
//any dynamic effect description updating
the transform node…
</X3D>
```

```
//Extension
<X3D-nav-extension>
  <Navigation
   DEF='object x transportation'>
     <Transform
       DEF='position-relative-to
            object'…> //Origin
        <Viewpoint
          DEF='navigation viewpoint'
          description='transportation
                       with object x'…/>
     </Transform>
     <Inline url='"object x.wrl"'…/>
  </Navigation>
</X3D-nav-extensions>
```

The Web element usage is split up into three phases:

1. Entering transportation / take role
2. Drive with transportation / navigate dependent of role and degrees of freedom (fly, swim, walk etc.)
3. Exit transportation / switch back to default role or use a new one

Concerning hyperworld traveling the visual perception problem of empty space behind a world with no visual boundaries had to be solved (e.g. open door in Figure 5). According to existing or not existing boundaries of the involved hyperlinked worlds (closed rooms or open environments) inside or outside views are needed. The arising textures of each world will be mapped to a cylindrical or room-based background object.

```
<!element hyperdoor (Viewpoint, Inline,World1,World2,Background1?,Background2?>
```

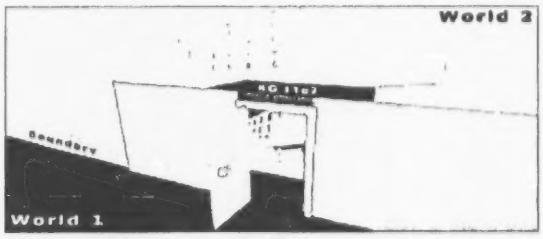

Figure 5: Using a hyper (door) link and a background object, presenting the next world until it is really entered.

To enter the new world any selection had be performed (e.g. select a hyperlink, collide with an object, touch a touch-sensor). After this selection the new world will be uploaded. The solutions for long loading times is the integration of long tunnels or other room-based objects, because the pass through time could be used for loading the next world.

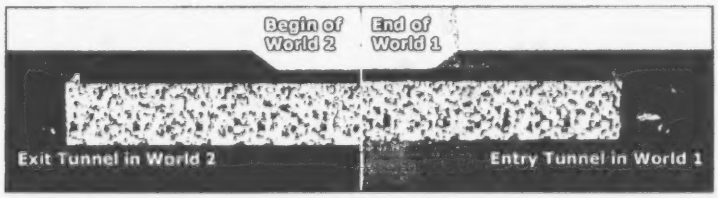

Figure 6: Walking/Driving through the hypertunnel takes time, could be used to load the next world

To simplify the first prototype implementation we had chosen only the usage of simple viewpoints for hyperlinking virtual worlds and no complex roles and transportation objects

Final Remarks and Future Work

Designer and user of virtual worlds have to decide whether it is useful to jump between to locations with the "beam me up" facility or to travel smoothly within or between virtual worlds according to the actual application domain. The change of roles and the usage of any autonomous element as transportation element will open new "points of view", use boats, cars, spaceships or switch roles from human, to fish to pelican. Switching between interactive and autonomous navigation extends virtual environment interfaces with new interactive features as well as guidance.
Using intelligent loading schemes could improve view and storage saving and support intelligent division of complex virtual worlds into several sub-worlds without problems of entry and loading. Within future implementations hyperworld traveling will be improved using complex transportation objects or virtual roles for the definition of the exit- and entry-point. The interactive definitions of new transportation objects or hyperworld linking as part of a browser interface are as important as the integration of extended perception features. The integration of stereo viewing or the definition of a set of more than two viewpoints e.g. to perceive the impression of viewing like an insect, as well as the combination of visual and haptic feedback [Becker, 2001] will provide users with complete new experiences within virtual 3D information spaces.

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The Internet as a Foreign Language Learning Resource

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Abstract: The purpose of the present paper is to give a brief survey of linguistically useful databases and tools available on the Internet. Drawing on the experience from a recent learning project at Göteborg university, the exposition is mainly confined to such ICT resources which involve the learning/usage of English.

1. Introduction

As a result of the rapid development of information and communication technology (ICT) in recent years, there are a host of interesting language learning resources on the Internet which are freely available to the enterprising student. Stored on various servers throughout the world, these resources consist of different types of (meta)language collections and specialized software applications: the former category includes database resources such as electronic handbooks (dictionaries and grammars), free text packages and language corpora, while the latter refers to sophisticated tools for language analysis and transformation, e.g. taggers, parsers, translators and summarizers.

Yet, while this smorgasbord of linguistic facilities has a wide range of educational application, the problem is usually that rather few language students are aware of what is on offer and how such resources could be applied to the everyday learning situation. The purpose of the present paper, therefore, is to give a brief survey of some relevant linguistic databases and tools, and to refer to some aspects of their usefulness in an educational context. Drawing on the experience from a recent learning project at Göteborg university, the exposition will in substance be confined to such ICT resources which involve the learning/usage of English.

2. Databases

As generally recognized, the mainstay of language learning is to be found in the fields of lexical, grammatical and pragmatic knowledge. On the Internet, there are a variety of databases which can assist the learner of English in these matters, focusing in particular on the study of fundamental lexis and grammar.

2.1 Handbooks

2.1.1 *Lexical resources*

One of the major database resources is the electronic dictionary. It comes in several different forms and sizes, all in order to satisfy the lexical needs of a variety of different learners. Thus, there are dictionaries which are monolingual (e.g. *The Cambridge International Dictionary of English*: http://dictionary.cambridge.org), bilingual (e.g. *The Lexin Lexikon*: http://www-lexikon.nada.kth.se/skolverket/sve-eng.html) or even multilingual (e.g. http://www.traducation.com/electronicdictionary.htm). Whereas these resources typically deal with a single (international) standard of English, there are other dictionaries which feature comparisons between two standard (or even non-standard) forms, so-called bidialectal dictionaries (e.g. *The American-British/British-American Dictionary*: http://www.peak.org/~jeremy/dictionary/dict.html). Diachronically speaking, there are etymological dictionaries (e.g. *Merriam-Webster Collegiate Dictionary/Thesaurus*: http://www.m-w.com/dictionary), providing lexical data with information about their historical origin and development, and also (collections of) historical dictionaries (e.g. *Early Modern English Dictionaries* (16): http://www.chass.utoronto.ca/english/emed/patterweb.html), i.e. dictionaries published in earlier periods of the language. A recent addition, thanks to the development of multimedia facilities, is also the so-called talking dictionary (e.g. *Encarta World English Dictionary*: http://dictionary.msn.com/Default.asp) where the pronunciation of lexical items is given in both graphic and auditive form. In general, the credit of these electronic dictionaries is that they are interactive, up-to-date and convenient to use, and that they cover, collectively speaking, a substantial part of a vast multilingual lexical field which it would otherwise be difficult to find swift access to.

2.1.2 *Grammatical resources*

On the grammatical side, we find a good selection of electronic handbooks dealing with syntactic as well as inflectional and derivational aspects of language. Representative examples include *The Internet Grammar of English* (http://www.ucl.ac.uk/internet-grammar) and *An On-Line English Grammar* (http://www.edunet.com/english/grammar/toc.cfm). Through resources of this type, the learner can access information on a variety of grammatical facts, view (often authentic) examples of target constructions, and even test their comprehension of the contents by means of selected exercises (with immediate feedback provided by a server). Indeed, in that respect, some of these sites come close to offering full-fledged grammar courses. Another versatile type of grammar database is represented by *The Leicester English Grammar Project* (http://www.le.ac.uk/ee/jmc21/legp/), providing information and quizzes not only on present-day English grammar but also on earlier varieties of the language, such as Old English. Given their easy-to-use hypertext interface, often with built-in search applications, these electronic handbooks seem to increase the motivation of many language learners in their grammar studies and to facilitate their understanding of the subject. On the down side, however, we must note that there is a great deal of variation in the grammatical terminology used, a situation which detracts somewhat from the general pedagogical value of these databases.

2.2 Text collections

2.2.1 *Free text collections*

Free text resources on the Internet consist basically of collections of literary or journalistic publications. On the literary side, there are a host of electronic writings available, including not only fiction but also drama and poetry: one good starting-point, for example, is a site called *English Literature Sources on the World Wide Web* (http://www.rice.edu/Fondren/Netguides/eng.html), which features an A-W list of literary works, from African American women writers of the 19th century to the William Blake archives. On the journalistic side, there are a wide selection of newspapers and magazines on offer, e.g. the *Guardian*, the *Independent*, *USA Today* and the *Hindu*, as well as *Time*, *Planet Science* and *BBC Top Gear Motoring*, all of them made available under the heading *English newspaper collection* (http://www.geo.ed.ac.uk/home/news.html). For both types of text, it turns out that they can be used profitably for the systematic study of language and/or content, with particular reference to the structural mapping of specific text types.

2.2.2 *Corpora*

Language corpora are probably among the most useful web resources available for language learners. Made up of samples of texts or utterances which are designed to be more or less representative of a language or language variety, and which are made accessible through a search interface, they are represented in particular by so-called standard corpora, e.g. *The Cobuild Corpus* (http://titania.cobuild.collins.co.uk/form.html and *The British National Corpus* (http://thetis.bl.uk/lookup.html). These corpora contain written (90 per cent) as well as spoken (10 per cent) language produced during the 1990s: the former consists of a 56-million-word selection from the Bank of English, including both British and American English, while the latter is comprised of 100 million words of British English only. The main virtue of these databases is that they can be employed to look up the usage of all sorts of (reasonably frequent) present-day English language patterns, be it syntactic constructions, lexical collocations, idiom applications or spelling conventions, providing frequency figures for different alternatives.

2.2.3 *Search engines*

Also, as a helper in the use of web-based textual databases, the language learner is equipped with a set of search applications which are able to scan the Internet for specific types of (language) information. Most of them are of the general search engine type which is designed to find web pages containing a predefined search string and present addresses to these pages in the form of a list of hyperlinks, e.g. *All the Web* (http://www.alltheweb.com) and *Google* (http://www.google.com/). However, there are also more sophisticated versions of such engines, e.g. *WebCorp* (http://www.webcorp.org.uk). This application does not only find relevant web pages but also present their contents in the form of a KWIC concordance, i.e. a list of matches where the sought-for item is highlighted and accompanied by its own linguistic context. In this capacity, WebCorp makes it possible to use the huge amounts of text published on the Internet as a unified language corpus, in principle functionally equivalent to the Cobuild and BNC corpora, since it produces the same kind of output.

3. Tools

The linguistic tools available on the Internet relate to more sophisticated aspects of language study. On the one hand, they provide learners with an opportunity of performing different types of grammatical analysis, either in terms of word class tagging or constituent parsing; on the other, they offer a means of transforming texts, either in terms of translation from one language to another or condensing a full text into a short summary. However, it should be noted that most of these applications tend to suffer from accuracy problems, in particular the transformation software.

3.1 Analysis applications

3.1.1 *Taggers*

Web-based taggers typically deal with categorial identification. Focusing on the lexical level, the application analyses the word class patterns of a text and adds interpretive labels (or tags) to the words involved, e.g. *noun* (*NN*), *verb* (*VB*), *article* (*AT*), *conjunction* (*CJ*), etc. (often with further subclassification). Representative examples of this type of tool include the *UCREL tagger* (http://www.comp.lancs.ac.uk/computing/research/ucrel/claws/trial.html), the ENGTWOL tagger (http://www.lingsoft.fi/cgi-bin/engtwo) and the MBT tagger (http://ilk.kub.nl/~zavrel/tagtest.html). To take an example, if the UCREL tagger is given the task of analysing the sentence *A language is a dialect that has an army and navy*, the following tags are returned:

A_AT0 language_NN1 is_VBZ a_AT0 dialect_NN1 that_CJT has_VHZ an_AT0 army_NN1 and_CJC navy_NN1

Having a rather detailed appearance, these automatically assigned tags seem to correspond quite well with the general consensus of word class identification in English (with the possible exception of *that*, which is here classed as a conjunction rather than as a pronoun). In other words, this is a potentially useful tool for students trying to break into the charmed circle of English grammar.

3.1.2 *Parsers*

Parsers are similar to taggers in the sense that they add interpretive labels to a text. The difference is, however, that they deal with functional rather than categorial identification, i.e. the output of the parser is typically a set of constituent labels, e.g. *subject*, *predicator*, *direct object*, etc. Accordingly, the analysis aims at the phrasal rather than the lexical level. The *Functional Dependency Grammar (FDG) parser* (http://www.conexor.fi/analysers.html#testing) and the *ENGCG parser* (http://www.lingsoft.fi/cgi-bin/engcg) are good examples of such applications, the former building functionally labelled dependency links between constituents and the latter providing shallow syntactic analysis of constituents on the basis of morphosyntactic tagging. By this description, it is also made clear that parsers and taggers tend to work together, and that it is sometimes hard to draw a sharp line between them, functionally speaking.

3.2 Transformation applications

3.2.1 *Translators*

Among the tools for textual transformation, the electronic translator is clearly a resource which carries an interesting learning potential. Using this type of application, it is in principle possible to key in a text in one language and have it immediately translated into another. Such translators include *Babelfish* (http://babelfish.altavista.com/translate.dyn) and *Promt's Online Translator* (http://www.translate.ru/eng/), both of which offer a choice of translation from/into a set of major Western languages, e.g. English, German, French and Spanish. Unfortunately, the accuracy of these applications varies considerably: in some cases, the translation of a simple monotransitive sentence can go completely wrong, as when Babelfish translates *She kicked the bucket* into German *Sie trat die Wanne* and then back into English *It stepped the tub*; in other cases, the performance is much better, as in the suggestion of Promt's Online Translator to translate a complex sentence such as *England expects every man to do his duty* into Spanish *Inglaterra espera que cada hombre haga su deber(impuesto)* and then back into English *England hopes that every man does his(its) (well versed) duty*. Given such accuracy fluctuations, it goes without saying that these translators are potentially hazardous to language users and should therefore be employed only with great precaution.

3.2.2 *Summarizers*

Finally, there is also a recent addition to the category of language transformation tools, viz. the summarizer application. Represented here by the *Multilingual Interactive Document Summarizer* (http://messene.nmsu.edu/~mcm/minds/MindsDemo/mindsDemo.html), this tool is designed to give users an opportunity to condense a text into a relevant summary in the range of 5-30 per cent of the original. Again, however, functionality problems arise when the tool is put into practice. When given the task of summarizing (at the 5-10 per cent level) the first section of the present paper (1. Introduction), the application returned the following "summary":

> Yet, while this smorgasbord of linguistic facilities has a wide range of educational application, the problem is usually that rather few language students are aware of what is on offer and how such resources could be applied to the everyday learning situation.

As this output is identical with the first sentence of the second paragraph, it is clearly far from being a proper summary of the original text. In other words, caution must again be recommended.

The Protection of Youth from Victimization in Cyberspace: Implications of Online Research for Practice and Policy

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Abstract: This baseline study of online activity among adolescent girls in the United States and New Zealand focuses on identifying the prevalence of participation in at-risk behavior in cyberspace that may result in abuse and exploitation. The information is important for the design of prevention and safety programs for adolescents engaged in online activity. Survey results confirm that a significant number of adolescent girls are engaging in risky activities when online, including disclosing personal information, sending personal photos to online acquaintances, and arranging face-to-face meetings. Many respondents continue potentially problematic offline practices as a result of these online interactions. The data also suggest that there is a lapse in preventative intervention to create and maintain awareness and safety for young people.

As a new phenomenon there is a paucity of research or models to predict the likelihood to engage in at-risk activities online which may be associated with subsequent exploitation. Whether social interactions in cyberspace are beneficial or problematic may depend on the influence of parents, teachers, and peers whose guidance may assist students in making informed decisions and allow them to demonstrate an ability to apply online critical thinking skills and productive social participation.

In a web-based study conducted in conjunction with Seventeen Magazine Online, CyberAngels, the College of Education at the University of South Florida, and the Department of Child and Family Studies at the Louis de la Parte Florida Mental Health Institute, an online survey was developed and placed on the Seventeen Online site to assess level of Internet use, involvement in varied at-risk behavior online, incidents involving negative interactions in Cyberspace, and perceived mechanisms to promote safety and well being. The differences in girls' use of technology (AAUW, 2000) combined with data confirming adolescent girls as the group most likely to be targeted for assault (National Center for Missing and Exploited Children, www.missingkids.org), established the need to devote the study to investigation of girls' experiences in cyberspace. Subsequent to release of the U.S. study results, the online survey was replicated by a child advocacy group in New Zealand, a country that has implemented a national Internet safety initiative.

Among both study groups, 14-16 year old girls comprised the largest pool of respondents. Among the U.S. survey participants approximately 50% spent less than six hours online weekly compared to 44% for the New Zealand group. The percent of users online six to nine hours per week was nearly identical for both groups; however, New Zealand girls exceeded their U.S. counterparts in the percent online for over ten hours per week (33% vs. 27%). Both groups primarily accessed the Internet at home, and instant messaging was universally identified as the most popular activity. In both countries the percentage of adults monitoring the use of the Internet was quite small (<4%)and is a likely contributor to at-risk behavior in impressionable teens. Among all respondents in the Berson, Berson and Aftab study (1999), less than 4% indicated that a parent, caretaker, or teacher always discussed their online activities with them. 26% occasionally were engaged in a discussion about their online activities. 38% rarely were asked to discuss their online experiences, and 31% indicated that adults never discussed their online activities with them. Yet this dialogue with significant adults seemed to make a difference for many young people.

Patterns of Interaction Online

In the study, many of the reported online interactions focused on a culture of deception in which some

respondents primary activities involve the exchange of verbally harassing or sexually suggestive chat. In contrast other young women are using online dialogue as a way to empower themselves and find a voice. In face-to-face interactions they may perceive that superficial characteristics (body size, facial features) are judged as more important than personality. These visual cues are not available during online exchanges. In AAUW's study of teenage girls (1999) many girls admitted repressing their authentic self in order to fit in with peers. However, in cyberspace, the pressures to fit in and act a certain way are moderated by the perceived anonymity and false security of being protected behind the computer screen, often in the comfort and safety of one's home. Cyberspace provides girls a context where they can shed their traditional expectations and explore alternative aspects of themselves. After all, "the computer can't see you blush" when you enter this fantasyland where the innocent can be sexy, the obedient can be naughty, and even the meek can swear with the best of them (Berson, 2000).

The at-risk activity of disclosing personal information was more prevalent among the U.S. respondents (59% compared to 34%), but actually meeting or agreeing to meet someone as a result of an online interaction was nearly twice as common among New Zealand girls compared to U.S. participants (24% compared to 12%). Both groups were equally prone to send pictures of themselves to someone they met on the Internet (approximately 25% of the respondents).

Development of a Victimology Profile

Using the results from the Seventeen online survey of adolescent girls, our ongoing analyses are focusing on development of a victimology profile based on probability of online risk. We have used logistical analysis to isolate variables that predict at-risk activity. The participants reported online experiences which challenged them to confront choices conflicting with the development of attitudes, values, and social functioning. These dependent variables include giving out personal information online, agreeing to meet with someone, receiving or sending photos, receiving and sending suggestive or threatening email, and participating in chatrooms where the content resulted in discomfort. They also identified factors which may moderate risk (independent variables), and these variables have been used to develop odds ratios and subsequent log of the odds through a logistic regression model. These include preventative activities (supervision, education, discussion) by significant adults (parents and teachers). Initially the log odds are being modeled as a linear function of the predictors, and then more advanced measurement analysis will result in consideration of multiple predictors simultaneously.

We have considered a logistic regression where the log odds of agreeing to meet with a stranger are modeled as a function of discussing Internet safety with a teacher, discussing Internet safety with a parent, and the interaction of these two predictors. The interaction is statistically significant, leading us to conclude that the effect of teacher discussion on the predicted log odds depends on whether or not there was a parent discussion. If there was no parent discussion, the odds ratio for the teacher discussion variable is .580. If there was parent discussion, the odds ratio for the teacher discussion variable is .822 (.580*1.418). In both cases having discussed Internet safety with a teacher reduces the predicted odds of agreeing to meet with a stranger. The effect of teacher discussion, however, is greater when there has been no discussion with a parent.

In the New Zealand sample of 344 girls, 81 indicated that they agreed to meet a stranger in person. The odds of this behavior occurring are .308, but these odds are unequal across groups. Agreeing to meet a stranger may be a function of age. Based on the study results, as adolescent girls get older, the odds of agreeing to risky behavior increases with 17-18 year olds almost four times more likely to meet a stranger than 12-13 year olds.

Similarly, the advice or counseling that the individual received may also influence agreeing to meet a stranger. An odds ratio calculation with the New Zealand sample indicated that girls who have not read or head about Internet safety from parents or caregivers were certain to agree to meet with strangers. On the other hand, adolescent girls who had a discussion with parents reduced their odds of engaging in this potentially dangerous behavior. More specifically, girls who had not discussed Internet safety with a parent or guardian were almost four times as likely to agree to meet with a net acquaintance.

The resulting model of risk and intervention will be used to inform knowledge of the experience of a large sample of adolescents and will contribute to more intensive projects to understand mental health issues associated with online victimization of youth. This information is being applied to the development of cybersafety interventions and public policy through cross-national collaborative efforts.

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The dangers of IT enthusiasm.

One of the dangers that lurk in the path of new technologies is to be undermined by the very use they have been chosen to deliver by us enthusiasts of IT. Uses that are innappropiate for them, or even when they may be worthwhile, they do not take full advange of that certain technology´s potential may end up making it seen rather banal.
This is specially so when the saying "there is no second chance for the first impression" applies. Non technical people who witness for the first time a demonstration of a new technology that fails, or proves unsatisfactory, do not necessarilly distinguish content from container, do not always differ the technology with the specific use it has been given. The tendency to be prejudiced against the technology developes, when the responsibily of that failure is in the mismatch of use versus the technology chosen.

To dimish this "danger from within" the very IT members, I have given a few of the available technologies some thought, and have come up with some hopefully useful and simple checklists, based on 10 years in charge of academic computing, and before that as academic software developer/faculty. Self deprecatory humor is included.
The idea is to take a quick, practical look at a couple of checklists to see if an adequate number of points are met to insure the appropiateness of the technology to the occasion or content.
What should be taken into account when putting teaching material on the Computer?.
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The dangers of IT enthusiasm.

One of the dangers that lurk in the path of new technologies is to be undermined by the very use they have been chosen to deliver by us enthusiasts of IT. Uses that are innappropiate for them, or even when they may be worthwhile, they do not take full advange of that certain technology´s potential may end up making it seen rather banal.
This is specially so when the saying "there is no second chance for the first impression" applies. Non technical people who witness for the first time a demonstration of a new technology that fails, or proves unsatisfactory, do not necessarilly distinguish content from container, do not always differ the technology with the specific use it has been given. The tendency to be prejudiced against the technology developes, when the responsibily of that failure is in the mismatch of use versus the technology chosen.

To dimish this "danger from within" the very IT members, I have given a few of the available technologies some thought, and have come up with some hopefully useful and simple checklists, based on 10 years in charge of academic computing, and before that as academic software developer/faculty. Self deprecatory humor is included.
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Student Perceptions of Team-Taught Site-Based Mathematics Course

Sally Blake, UTEP, USA ; Mourat Tchoshanov, UTEP, USA; Art Duval, UTEP, USA ; Connie Della-Piana, UTEP, USA; Sandra Hurley, UTEP, USA

University professors move classes to a local middle school in an attempt to increase mathematical conceptual knowledge through a teacher assessment model.

Title: Collaborative Learning – Tools from The Education Network of Ontario

Mr. Val Blokowski, Executive Director, The Education Network of Ontario

Summary
In this paper I will discuss how the Education Network of Ontario was established, the service it provides to the education community in Canada and overseas, and explain our approach to online learning through specific student projects, their relevance to the curriculum, and how we have created online simulations that are based on topical events that have greater meaning for students.

Introduction/Context

The Education Network of Ontario (ENO) was founded in 1993 as a collaborative project between the Ontario Ministry of Education and Training and the Ontario Teachers' Federation. We incorporated in 1997 and are a private Canadian not-for-profit corporation.

The Education Network of Ontario provides a wide range of telecommunication services for the Junior Kindergarten to Grade 12 education community in Ontario, including Internet access, member email accounts, student and teacher education projects and over 185 online education conferences and newsgroups.

Internet access for members is provided by us as one of Ontario's largest Internet Service Providers (ISP) serving members through 25 local dial-up servers and 1-800 access for members outside of the local dial-up server areas.

We use a web-based conferencing system to provide users with over one hundred and eighty moderated conferences and discussion groups, in English and French. A wide range of topics such as educational reform, curriculum development and equity give educators from all parts of the province an opportunity to discuss issues related to education. ENO users have unlimited access to international electronic mail.

The initial stage of the Education Network of Ontario was a UNIX-based, cross-platform, TCP/IP protocol distributed network application which provided bilingual (English and French) electronic mail, moderated conferencing (facilitated newsgroups), and database and Internet access across Ontario. It started with just eighteen members in 1993 and has grown to register more than ninety thousand teachers, administrators, trustees and education faculty, well over half of the K-12 education personnel of the province. The organization, a public sector Internet and Intranet Applications Service Provider has moved from project funding from the government to an independent not-for-profit corporation with an active and informed Board of Directors selling services to various levels of government and public sector organizations.

The project has retained dial Internet access from any home, school or cottage location in Ontario and mail and conferencing services. However, ENO is fully retooled to enable browser-based moderated Intranet newsgroups, model classroom projects with interactive web creation scaled to suit 100,000 teachers as they develop creative, industry-standard content. A bilingual call centre supports all of the members and a web site supplies automated tools for registration and access and service 'fixes'.

Statistical Notes

Quantitative analysis tell us that our membership of 90,000 educators use the dial access an average of 18,000 times a day. Statistics show total online time of nearly 20,000,000 minutes a month. Our servers handle as many as 100,000 messages a day. Some of our classroom activities sites register as many as 30,000 hits a day during peak activity times. Analysis indicates a tremendous interest in and usage of the Internet and our resources with 90% of the connect time after school and all through the night.

Teachers' Practices

Our anecdotal analysis and day-to-day experiences tell us a great deal about how educators use this suite of services. One focus of the teachers continues to be moderated conferences/newsgroups that they open to solve such endemic concerns as 'local' versus 'standardized' evaluation, reporting to parents, community work/learn programs, and general subject-based or level-based curriculum issues. Whenever a new provincial license for software is purchased, a conference is opened in which the technical support team from the vendor can discuss issues of use and technical implementation. This 'mode' has expanded to include professionals from the Addiction Research Foundation who help teachers work positively with addicted students and the addiction resources regularly circulated to schools as a part of this agency's mandate. A large school district's school custodians are working on practical identification and warnings about workplace issues and hazards.

Smaller groups of teachers voluntarily initiate a series of professional activities such as writing primary school curriculum units themed on ideas such as two-dimensions – measurement, journaling, drawing, electronic and snail mail. This arose from a typical and very successful example, the web-based project devoted to showing young students how to conceptualize two dimensions with a central fictional character called 'Flat Stanley'. After the provincial collaboration, teachers mount and maintain the curriculum units on an ENO web site. The project is now international with hundreds of schools participating.

Model Classroom Projects - Overview

We have developed several curriculum activities to encourage appropriate use of the Internet by students. These activities have been developed using a basic framework that can be applied to other curriculum projects. All projects focus on problem-solving activities that encourage students to develop enquiry and research skills. These online simulations are based on topical events that have greater meaning for students.

Communication

Communication is a key aspect to all student projects. Participants are provided with an account on the Education Network of Ontario system. We do this in a secure environment. Student access to the ENO system includes the ability to use email, work in moderated conference areas and create web pages specific to their project. This provides for effective on-line communication for all partners in the program. All projects have a unique web site that serves as a place where teachers and students can obtain up-to-date information about the project and activities. These interactive web sites allow for student-to-student conferencing, online mentorship and the sharing of information. Students use a series of web pages to showcase their work.

Access to specific sections of the projects or online simulations is open to the public and other parts of the programs are closed to registered participants. A series of conference areas promote dialogue among elementary students, secondary students and professional mentors. Students are expected to have a basic level of computer and Internet technology skills at the start of the project. Additional skills are gained throughout the project.

Team Web Pages

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A unique model for developing team web pages has been created. Basic templates are used in all projects that are simple to use yet effective in their application. Student teams can upload text, graphics and files to their team web sites. These pages are live on the Internet as soon as the work is submitted. There is the ability to have project participants make comments on the team pages and therefore students receive authentic feedback on their work. This allows students to work collaboratively on their project.

Curriculum Connections

All Student Projects are tied closely to provincial curricula. Teachers are provided with a series of matrices that demonstrate the skills and knowledge acquired through the different programs. Evaluation strategies are included in each project to assist teachers as they work with this new approach to learning.

Expert Mentors

One of the most rewarding aspects of our Student Projects is the involvement of expert mentors. These volunteers work in the classroom and online with teachers and students and offer real life experiences for the participants. Mentors participate actively in newsgroups and answer questions from students across the country. University students from many Canadian institutions work in the online environment providing feedback to the younger students as they make their plans. The involvement of experts in the field of science, technology and engineering provide authenticity to the programs. Several projects use secondary level students as mentors for elementary students. This cooperation between schools enhances the understanding of the concepts being covered by both groups of students.

Examples of ENO Student Projects

I will describe three ENO Student Projects to illustrate our successful approach to online learning.

Community Project

This online simulation activity is aimed at students at the middle school level. Students are presented with the challenge of designing and constructing a model Community and Cultural Centre in the community of Enoville. In order to have their construction companies considered for the project, student teams (an engineer, architect, land developer, and town planner) must complete a community profile of their local area. This is submitted online to the virtual "municipality" for approval. Once approval has been gained, students must complete a series of tasks throughout the project including a Public Meeting utilizing videoconference technology.

The Planning Process for the students is as follows:

- Create a Design Company
- Develop a Local Community Profile
- Examine the Enoville Profile
- Determine the Location of the Community Centre
- Submit a Formal Proposal
- Present their Materials at a Public Meeting
- Complete the Master Planning Process
- Present their Materials at a Second Public Meeting
- Construct the Community Centre
- Open the Community Centre through a Virtual Ceremony

Student construction companies use their web pages to showcase their work. As students work through the planning process, they are able to show their work through the Internet and get advice from the online community as their plans for the local centre are developed.

Throughout the 8-week project, secondary school students and professionals in the community mentor elementary school students. These roles include engineers, land use planners, members of the local municipality and staff at various government agencies. They provide feedback and advice to the construction companies at all stages the program. This is a vital component of the program and serves as a model for online collaboration and partnership. It provides teachers at the elementary school level with a way of working with experts in the community. They can also benefit from the expertise of the High School students who are experts in urban planning and geography. This mentoring is done by email, by answering questions in the newsgroups and by making comments directly on the students' web pages. This interaction provides authenticity to the project. All groups benefit in this arrangement and the younger students gain valuable feedback on their work.

Canadian National Marsville Program

One of our largest projects involving 4,000 students and teachers across the country is a complete online and face-to-face environment, the Canadian National Marsville Program. It is a content, activities and teacher professional development project based on the concept of intermediate-level students creating a living environment for themselves as pioneer astronauts and settlers of Mars. Students work through four months of content and activities about their survival. They upload team mission patches and then their air, water and food supply system drawings to their team's web pages. They access mentors' comments from Spar Aerospace and the Canadian Space Agency. They communicate with one another as they improve their devices and prepare for the final 'link-up' day. Using this on-line environment prior to the face-to-face event enhances classroom learning. It is not an add-on or a distracter for offline activities.

The Canadian National Marsville program is an Internet-based simulation of the first colonization of the planet Mars. Student teams from Grades 5 to 9 are assigned the task of creating a self-contained settlement on the planet that will allow them to conduct scientific and engineering activities while on the planet. The program runs simultaneously in several centres across the country. It runs from late January until the final Link-Up day event on April 28, 2001.

As part of the cross-Canada Marsville program, students work in teams in their classes and communicate through Internet connections with their counterparts in other regions of the country. Scientists and engineers serve as mentors and work directly with teachers and students in the classroom and on-line as they design their version of the settlement on the red planet. The success in the completion of the program depends on cooperation and teamwork. Throughout the activities, students are provided with opportunities to share their experiences and knowledge with their peers as well as with a wider audience.

I'll describe each of the two phases of the program.

Phase One - Preparation for Mars

Marsville encompasses educational activities inside and outside the classroom. Students are assigned roles within the context of the larger Martian settlement. Mission teams solve simulation-based problems using the Marsville materials. Each team of 6-8 students must design and construct a working model of one of the nine life-support systems required for the settlement.

In order to live on Mars, students must find out more about the planet. They learn about the atmosphere, terrain, climate and the complexities of living in this environment. Once they are familiar with the harsh conditions of the planet, they are able to start to plan their life-support system for the settlement. Student teams must discover how their life-support system operates here on Earth. They conduct research in their own local area and contact local community members for assistance. Student then gather information from other Canadian sites in order to discover the diversity of the country and the need to take many issues into account while designing their system. They use Internet to share ideas with students across the country.

Each mission team is partnered with two teams from nearby schools. These three teams comprise a Habitat Crew, communicating with each other through written and electronic means only. The Habitat Crew is responsible for cooperatively designing and constructing their section of the settlement that will house them on Mars. They will be responsible for building a large dome for their crew when they arrive at the Marsville settlement. These teams do not meet until the final Link-Up day event at the conclusion of the research stage. Their planning has taken place over the Internet! This stage lasts approximately 10-12 weeks.

Phase Two - Link-Up Day

On April 28, 2001 all the mission teams in each of the Canadian sites gathered to construct their own Marsville settlement. Crews set up their physical solutions to the specific Martian biological or social system previously assigned to them. Students shared their problem-solving strategies, successes and challenges, and worked on their final project - the governance of Marsville. On Link-up Day (LUD), the Canadian sites were connected through videoconferencing systems allowing the explorers to "meet", on-screen, their fellow space travelers across Canada and to compare solutions.

Throughout the Link-Up day, each site was able to use the Internet Cafes set up at their location to communicate with other Marsville explorers. Students used digital cameras during the day to take pictures of their habitats and system designs to show others what is happening in their part of the settlement. These digital images were posted on the CNM web site as they were taken and broadcast to all the Canadian sites. This live interactivity means that students can work in real-time to compare their Marsville activities. In addition, parents and community members who were not able to attend the actual event were able to watch the progression of the Marsville colonies. The event now has a global audience with the inclusion of these Internet activities.

Robotics Challenge

The Robotics Challenge is a unique multi-year educational project aimed at students in grades four to twelve. It provides opportunities for students to learn about science, technology, math and design through the development, programming and testing of autonomous robotic devices using the LEGO ROBOLAB materials. Funding has been provided through the Ontario Ministry of Energy, Science and Technology's Youth Science and Technology (YS'nT) project. The Challenge is a joint initiative with Ontario School Boards, Spectrum Educational Products and the Education Network of Ontario. Over forty School Communities will be involved by the end of 2003

A large professional development component is included as an integral part of this program. In the first year of the project, twenty-two lead teachers from across Ontario will use the ENO web site to discover how to use the ROBOLAB materials in their classrooms. An online tutorial, conference areas and team challenges will ensure that teachers are successful. Videoconferencing cameras will be used to enhance this online training. The following year, these lead teachers will mentor additional teachers from other school communities.

A variety of regional events are planned to provide opportunities for students to demonstrate their skills with ROBOLAB. Online events will include team challenges, data collection and sharing of programming knowledge.

Research

In all of this activity, ENO is in varying degrees enabling personal, small group and province- and nation-wide professional development. One of our projects involved developing on an on-line course about telecommunications and writing for the technical environment for senior secondary students in English or Business Studies. We found that there were two distinct types of professionals at this time. The creation of modules of a course requires a tremendous amount of design, content knowledge and technical skill. Many teachers could create small modules of engaging material. However, the ability to knit together usable modules for online and fact-to-face which would withstand scrutiny was not a part of every interested teacher's agenda. Those who had deep skills and interest were interested in operational structures for courseware, markup standards such as SGML and XML that would produce a stable course framework, testing procedures that involved feedback from students, and Intranet applications such as newsgroups and chat to support 'classroom routines'.

A second research project involved working with and training aboriginal moderators for newsgroup systems since their population is widely distributed in far northern rural and urban areas and much of their education and community practice depends on online access and newsgroups. The adoption of our multi-display and access newsgroup system is evidence of our success. We are also technical partners developing dynamic and managed caching systems for groups like them with limited resources and digital access in our far north.

Research such as this has led The Education Network of Ontario to be a member of the client community for the TeleLearning Network of Centres of Excellence program and corporation. We are now represented on the Board of Directors and are serving as Chair of the Board. We are working on an agent-based portal and professional portfolio project for individual and small group educational professional development. The research reports and 'lessons learned' from this virtual network of researchers inform our practice and development at every turn.

Partnerships and Sustainability

Because our budget is overwhelmingly involved in the accomplishment of our core activities, we use technical research partnerships with organizations such as Group Telecom, Cisco, Virtual Talker, and Telus to work toward our objectives of seamless and intuitive access to industry-standard and integrated applications such as Voice over IP and interactive video.

Our work with the Ontario education community has burgeoned to other Ontario and Canadian government ministries and jurisdictions. This gives us economy of scale and allows us to move services through a developing spectrum not dependent on individual contracts.

We are called upon to export our expertise to work with education in Jamaica and China. We are using our experience as the model for integrating technology into the new secondary curriculum in Brazil. This will involve four projects in all of the provinces and with nearly one hundred schools and hundreds of teachers over the next three years.

All of this creates a healthy and knowledgeable corporation able to develop and offer vertically integrated services to communities, professional groups and government ministries and agencies.

XML-Based Content Object Reference Builder

Paul Bohman, Utah State University, USA; Shane Anderson, Utah State University, USA; Jeff Isom, Utah State University, USA

The challenge is to create a truly useful Web-based reference resource that can house massive amounts of content (both informational and instructional) in various formats, and serve it out in ways that are appropriate for audiences of various levels of expertise in the subject matter. It isn't enough to store information. The trick is to organize it in such a way that it can be found quickly and easily. The purpose of Reference Builder is to create just such a system. The end-user is able to get in, obtain the necessary knowledge, and get out. The user could also choose to linger a while and participate fully in the instructional modules. At any time the user can contribute to the community by posting messages on the site. Finally, when the user returns, all of that user's highlighted sections, bookmarks and notes will be intact, thus truly becoming a personalized resource that will be used again and again.

Experiencing the Unseen, the Unheard, the Blurry and the Confusing: Simulating the Experience of People with Disabilities on the Web

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Abstract: In an effort to provide a method of inspiring greater conceptual understanding and affective response in learners who are being instructed how to design disability-accessible Web content, the authors created Web-based simulations to provide an environment in which learners can experience some of the same difficulties and frustrations experienced by people with disabilities on the Internet. Built-in instructional augmentations increase the instructional value of the simulations and allow the learners to focus on the most salient aspects of the experience, e.g. the unique challenges experienced by individuals with disabilities on the Internet.

Purpose of the project

The task of learning how to design Web pages that are accessible to people with disabilities is one that requires the acquisition of an appropriate skill set, knowledge base, conceptual understanding of why the task is necessary, and proper motivation. Obtaining the skills (e.g. using a computer, creating Web content) and the knowledge base (i.e. the background information about Web design and disability access guidelines) are requisite to the task, but these elements alone are insufficient to stimulate the conceptual and affective involvement of the learner. Without such involvement, the learner may be able to produce accessible Web content to some degree, but may still not understand why it is important to do so, or may make faulty assumptions based upon rote knowledge, rather than on a true understanding of the principles that make Web content either accessible or inaccessible to individuals with disabilities. The end result is that the learner may commit errors while attempting to produce disability-accessible Web content. In addition, the learner may question whether the task is necessary at all.

While all aspects of the learning process are important to the end goal of training learners to produce disability-accessible Web content, the focus of this project is on the design of instructional materials that facilitate the acquisition of cognitive understanding and affective motivation.

The reason for choosing simulations

There are many methods that could have been used to accomplish the instructional goal. However, when the end result is one of conceptual and affective response,

> [t]he most effective and efficient and instruction takes place through experiencing realia or models in the presence of a variety of instructional augmentations designed to facilitate learning from the experience (Gibbons 2000).

In this case, simulations are used to model disability types and specific adaptive technologies used by those who have these disabilities. The targeted, somewhat denatured experience offered by these simulations allows learners to momentarily experience the Internet as if they had the specific disability. The simulations can provide insight and a sense of perspective that is otherwise difficult to achieve. Mere explanations do not often carry the same weight as actual experience, even if that experience is only simulated and temporary.

Instructional features of the simulations

The simulations provide exploratory opportunities, to one degree or another, allowing the learner to interact with the environment in a non-linear fashion. Still, because the goal is instructional, some tasks have been given to the learner, and an introduction has been provided, so that the learner has some sense of purpose upon entering into the simulation environment.

In each case, the learner is given a task, or a set of tasks to accomplish. During the course of these tasks, the learner is likely to experience some of the same difficulties and frustrations that people with disabilities often experience. The completion of the assigned tasks is not the true instructional goal. The true goal is to feel, recognize and understand from first-hand experience the obstacles that people with disabilities face on the Internet. In order to ensure that the learner understands the simulation's true goal, an interactive debriefing is conducted at the end of the simulation.

Overview of the individual simulations

Blindness. People who are blind often use software that reads the text on the screen to them. This simulation provides a typical experience of what a user with blindness could encounter when trying to find information on a Web site. The learner is given the task to find three pieces of information. Keyboard commands are used to navigate through the site.

Low Vision. Individuals with low vision use screen magnification tools to enlarge portions of the screen. This simulation demonstrates what the screen would look like to someone who has partial vision. It also allows the learner to zoom-in on certain parts of the Web page to see the effects. Text stored as bitmapped images can become unreadable when magnified.

Color-Blindness. Someone who is color-blind can experience problems finding information on a website if the only indicator for the content is its color. This simulation provides a variety of real-life tasks for the learner to perform, such as choosing the correct route on a color-coded subway map. This task can be virtually impossible for someone who is color-blind. The learner is shown a Web page, as someone with color-blindness would see it. The learner is then asked to select the correct information on the page. Because color is the only indicator for differentiating between the items, the learner is forced to guess.

Cognitive Impairments. Users who are cognitively-impaired may have a difficult time finding information on a Web site. This simulation provides the learner with an opportunity to experience one type of cognitive disability by placing the learner in an over-stimulating environment. The learner is required to find specified information on a confusing site by navigating using the mouse. In addition to navigating, the learner is required to catch dropping bombs by moving a man back and forth across the screen using the keyboard. The simulation also contains distracting background noises. The combined effect of these stimuli creates an environment that makes it difficult for the learner to concentrate on the task of finding the specified information.

Hearing Impairments. The increased use of multimedia on the Web has created challenges for users who are hearing-impaired. This simulation allows the learner to experience some of the problems that a deaf or hearing-impaired learner might encounter. The learner is presented with the task of finding information on the site. The learner navigates through the site using the mouse, however much of the essential navigation content is in audio format only. While this can create an entertaining effect for most users, it makes the sight unusable to users who cannot hear. To create this effect, the audio portion of the site is turned off and the learner is forced to make a guess about what the links are for. The simulation also includes a task to find information from a news story that has no audio.

Motor Impairments. Motor impairments can make it difficult for individuals to use a mouse. In addition, users with motor impairments often use specially designed keyboards to input information. This simulation provides the learner with an opportunity to experience what an individual with motor impairments might deal with when filling out an on-line form. The learner is provided with a simulated alternative keyboard to use while entering all the data. In addition, there is a simulated trackball mouse. The use of these simulated adaptive technologies causes the learner's mouse pointer to move in a haphazard fashion, similar to the labored muscular movements of individuals with some kinds of motor disabilities. This causes the learner to miss keys they were intending to hit. In

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addition, a time limit is set for filling out the form. If the learner does not complete the form in the specified time period, the form will reset itself.

Conclusion

Because the idea of designing Web content with the needs of the disability community in mind is somewhat removed from the everyday experience of most Web developers, it is sometimes difficult to motivate them to design accessible Web content. It can also be difficult to explain to them the logic behind certain accessibility guidelines. By focusing in on certain challenges faced by individuals with disabilities, the simulations provide environments in which conceptual understanding and affective responses can occur.

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Determining Logical Document Sets in File Collections

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Abstract: When browsing through an intranet, the browser presents information which is often distributed over a set of many files. These files are then connected via hyperlinks or definitions of frame sets. For an information retrieval system it is very helpful to look at such a set of files as one unit - as a logical document.

Since the introduction of HTML 4.0, it is possible to add logical relations to hyperlinks, but this feature is used very rarely so far. So most HTML files do not contain any explicit information about logical units except the hyperlinks. On the other hand, many HTML files also contain hyperlinks to files outside their logical document. So the problem is to decide whether a set of files is linked strong enough to be looked at as one logical document, where the boundaries of such a logical document are and how to enter it.

In this paper we describe a method to detect logical documents within a collection of files. This method only uses knowledge about hyperlinks within the files and some features of the files like size and the position in a file system (i.e. the full path).

Introduction

The method described in this paper is part of a system called "WIR - Weaving Intranet Relations". The WIR system integrates algorithms and procedures of statistics, corpus linguistics, information retrieval and statistical pattern recognition in order to compute the similarities between all documents of a given collection or between an external document provided by the user and the documents of the collection. (Bohnacker, 1999 and 2000)
Currently the WIR system runs on an intranet with about 46000 HTML files. Knowing all the similarities between these HTML files, the system may be used as a kind of search engine where the user specifies his interests through the document currently displayed in his browser.
The main characteristic of the WIR system is that no external knowledge (lexicon, terminology, etc.), but only knowledge computed from the texts of the collection is used. Working with an early version of the system treating each single HTML file as a document we found that many documents were too small to gain any statistical relevance within the WIR system or to provide any value for the user. They are only useful when embedded in their environment (e.g. a frame set). This environment we call logical document.
Therefore we developed a method to detect logical documents within a collection of HTML files based on the links and frame set definition in these files. A collection of linked HTML files can be regarded as a graph with the files being the nodes and the links being directed edges between the nodes.

The Link Graph

A collection of somehow linked files can be looked at as a graph with nodes representing the files and directed edges representing the links between the files. In HTML a link is coded as hyperlink within a source file and points to a destination file. Since there are different types of links, we have to handle different types of edges. The first task is to transform a set of files into a computable representation of the link graph.

From Hyperlinks to Typed Graph Edges

We create a node for every file in the collection. Then we parse all files. For each node we determine the outgoing links, i.e. HTML links pointing to other files in the collection. We don't handle links pointing out of the collection. For each outgoing link we determine the node associated with the file the link points to (the destination node). The link information is stored twice: For the node where the link is defined (the source node) we store an identifier of the destination node and the link type (see Table 2). For the destination node we store an identifier for the source node and also the link type.

Adding Implicit Edges

A special problem with links to or inside HTML frames is shown in figures 1 and 2: File 1 defines a frame set, file 2 contains a table of content and appears in the browser window together with one of the files 3, 4 or 5. The frame links define a strong connection between 1, 2 and 3. But although 2 and 4 or 2 and 5 may appear together in the browser window in the same way as 2 and 3 do, there is no strong connection between these nodes, only simple hyperlinks. So a clustering algorithm would perhaps group 1, 2 and 3 together, but not 4 and 5 although 4 and 5 appear in the same context as 3. Therefore we add implicit frame links as shown in figure 3. This approach works for simple frame sets as well as for nested frame sets and for frames referred to from multiple files defining frame sets.

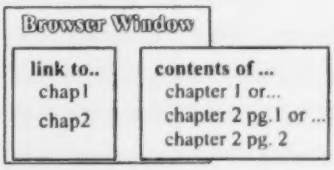

Figure 1: A typical frame set as displayed in the browser window

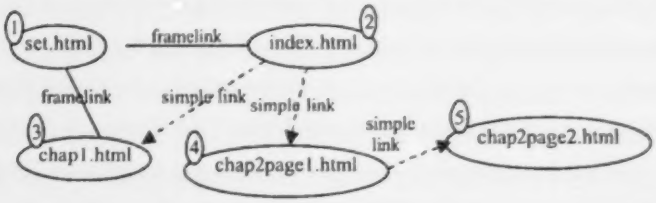

Figure 2: Links in the frame set

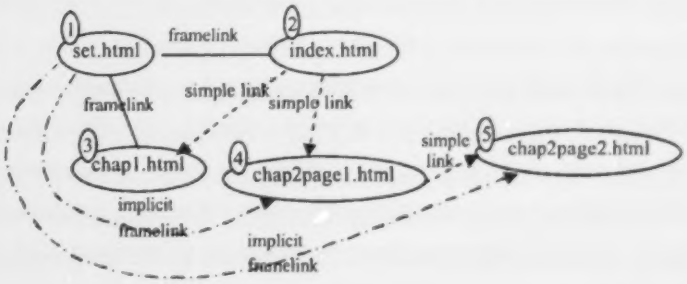

Figure 3: Links in the frame set with implicit frame links

From Typed Graph Edges to Weighted Graph Edges

When examining how HTML files are organized, we found the following statements to be true in most cases:

1. Files in the same frame set have a strong relationship, because a user can see them at the same time in the same browser window.
2. Files in an iframe (=internal frame) also have a strong relationship to their surrounding documents, but not as strong as frame sets, because usually an iframe is more an independent region.
3. Files linked with a simple hyperlink are not related as strong as files in a frame set.
4. Files with bidirectional hyperlinks - file A has a link to file B and file B has a link to file A - are related stronger than files with a simple unidirectional hyperlink.
5. If two linked files are on the same server in the same directory, they are related stronger than files in different directories. The larger the path distance between two files the weaker is their relationship. Two linked files on

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different servers only have the weakest relationship at all. The path distance is the number of directory changes necessary to get from the directory of file A to the directory of file B. Examples are shown in table 1.

6. If the logical links as defined in HTML 4.0 are used, the files have the strongest relationship at all.

file_A	File_B	path distance
/dir1/file_A	/dir1/file_B	0
/dir1/file_A	/dir1/dir2/file_B	1
/dir1/file_A	/dir2/file_B	2
http://server1/file_A	http://server2/file_B	9 (=max.)

Table 1: Examples for path distances

Once the graph is built with typed edges, the edge types are transferred to edge weights using table 2 as lookup table. This table shows the weight of an edge depending on its link type and the path distance. The weights in the table consider the six rules stated above.

typed edges \ path distance	≥3	2	1	0
unidirectional hyperlink	1	2	3	4
bidirectional hyperlink	2	4	6	8
iframe link	3	6	9	12
frame link, indirect frame link	4	8	12	16
logical link (HTML 4.0)	5	10	15	20

Table 2: Look-up table to transform path distance and link type to a weight

Detecting Subgraphs

A subgraph is a set of linked nodes in the link graph that have stronger links between each other than with their neighboring nodes not in the subgraph. Such a subgraph is considered to represent a logical document. So the task is to divide the link graph into subgraphs (top down approach) or to cluster the nodes of the whole link graph together to subgraphs (bottom up approach). When detecting subgraphs we have to consider the following aspects:

1. We have to define criteria to value how good a hypothesis for a subgraph is. These criteria are modeled as a combination of fuzzy functions (see Valuation Functions). Some of these criteria are application dependent.
2. We have to find an algorithm that finds a division of the graph into good subgraphs according to the valuation function mentioned above. From the view of graph theory one would prefer an algorithm that finds the optimal solution. However, due to the possible size of the graph - currently more than 46000 files - this is not possible. So we use a heuristic straight forward algorithm looking only one step ahead to find a good solution without running into combinatorial problems.
3. Obviously there are many files already representing a logical unit, even if they contain some links to other files. Therefore we prefer a bottom up approach starting with each file being a logical document.

Best Edges First

The idea of the *best edges first algorithm* is that in general the nodes connected with the highest weighted edges are the best candidates to merge to a logical document. Therefore if we process the edges in the order of decreasing weights, we have a good chance to avoid ambiguities at an early state of the algorithm and later these ambiguities will either have disappeared or – if solved in the wrong way – will not lead to further errors because they are processed near the end of the algorithm. In the following we summarize the algorithm in seven steps:

n is the number of nodes — i and j are nodes

(i,j) is the edge from node i to node j — $D_1 \ldots D_m$ are hypotheses for logical documents, i.e. sets of nodes

1. From the link graph create a *list of edges* sorted for descending weights
2. Create n logical documents, each containing one node in the link graph.
3. For each node set a *reach_all* flag. This flag means that from this node all other nodes in the logical document can be reached via links. This is true so far because all logical documents contain only one node.

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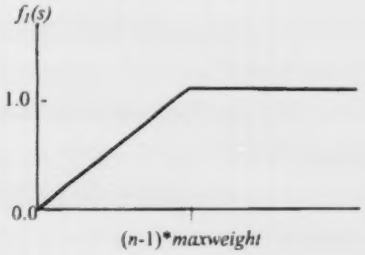
4. Take the next edge *(i,j)* with $(i \in D_k) \wedge (j \in D_l) \wedge (k \neq l)$ from the list of edges that fulfills the condition that the *reach_all* flag is set for node *j*. This condition ensures that there will be at least one node in the union of D_k and D_l from where all other nodes can be reached. The algorithm terminates if there is no more edge left satisfying this condition.
5. Value the union of the two sets D_k and D_l using the valuation function f_{VAL}, see below.
6. If the valuation exceeds a threshold *minval*, merge the logical documents D_k and D_l to logical document D_{kl} and update the *reach_all* flags of all nodes in D_{kl}.
7. Continue with step 4.

Valuation Functions

As described in the algorithm in step 5, we have to provide a valuation function f_{VAL} that values the merging of two sets of nodes – i.e. candidates for logical documents – D_k and D_l to a union set D_{kl}. f_{VAL} is modeled as a combination of the fuzzy functions described below.

Weights of all Edges: f_1

An important criterion are the weights of the edges between nodes inside the merged set D_{kl}: The valuation function uses the sum of the weights in relation to the number of nodes. This is not the same as the average weight, because there may be much more edges than nodes, what makes a logical document more likely.



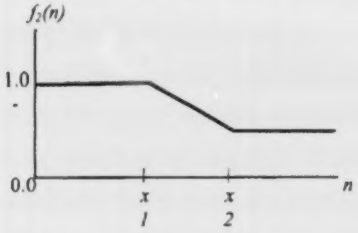
$$s = \sum_{inner\_edges} edgeweight$$

n = number of nodes in D_{kl}
maxweight = highest possible weight of a link as defined in table 2

Figure 4: Fuzzy function for the weights of all edges

Number of nodes: f_2

A logical document may consist of 1 up to ~100 files. Logical documents with several hundreds of files are not very useful. Of course this criterion depends very much on the application.

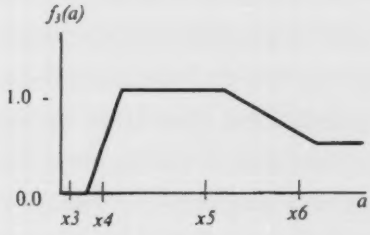


n = number of nodes in merged logical document D_{kl}
$x1$ = threshold where it becomes unlikely that a logical document consists of so many nodes
$x2$ = threshold where the certainty for a logical document does not decrease any more

Figure 5: Fuzzy function for the number of nodes

Amount of Text: f_3

Another criterion is the amount of text collected in a logical document. This again depends very much on the application and is correlated to the previous criterion:

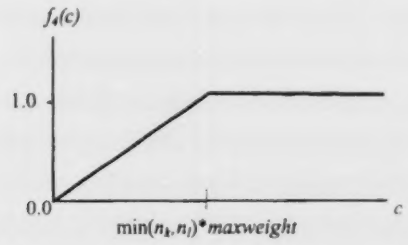


a = overall amount of text of merged logical document D_{kl}
$x3$ = minimum amount of text in a logical document
$[x4,x5]$ defines the optimal range for the amount of text
$x6$ = threshold where the certainty for a logical document does not decrease any more

Figure 6: Fuzzy function for the amount of text

Weights of Connecting Edges: f_4

The weights of the edges connecting D_k and D_l is another important criterion: The rating function uses the sum of the weights of the edges connecting D_k and D_l in relation to maximum weight of a single edge as defined in Table 2.



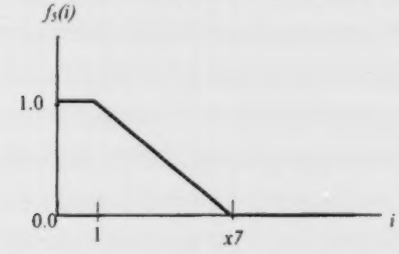
$$c = \sum_{connecting\_edges} edgeweight$$

n_k = number of nodes in D_k
n_l = number of nodes in D_l
maxweight = highest possible weight of a link as defined in table 2

Figure 7: Function for the weight of the edges connecting D_k, D_l

Nodes with Incoming Edges: f_5

Typically only one or a few files of a logical document are refered to from outside the logical document. Therefore if many nodes in set $D_{k,l}$ have incoming edges, this set is probably not a valid logical document. Anyhow, it may be a valid part of a logical document that can later merge with the other parts. So we have to take into account later – when combining the fuzzy function (see subsection 3.2.6) – that this criterion is only valuable when it is obvious that the set should not grow much more through future merges.



i = number of nodes with incoming edges in $D_{k,l}$
$x7$ = threshold where it is absolutely unlikely that $D_{k,l}$ is a valid logical document

Figure 8: Fuzzy function for the number of nodes with incoming edges

Combining the Fuzzy Functions f_1 – f_5

To value the merging of D_k and D_l to $D_{k,l}$ we combine f_1 ... f_5 as shown in the formula given below. We take the mean of f_2 (the number of nodes) and f_3 (the overall amount of text) because these two functions are correlated and should not become too dominant. We take into account that f_5 is valuable only with large sets by multiplying it with $n/x1$ and compensating this loss by adding $(1-n/x1)$. As defined in subsection 3.2.2, n is the number of nodes in $D_{k,l}$ and $x1$ is the number of nodes where a logical documents becomes unlikely.

$$f_{rate} = f_1 * \frac{f_2 + f_3}{2} * f_4 * \left(\frac{n}{x1} * f_5 + \left(1 - \frac{n}{x1} \right) \right)$$

Parameter Settings

The free parameters of the method are ...

- ...the weights of the links as defined in table 2
- ...the variables $x1$ ... $x7$ defining the fuzzy functions. The following settings lead to good results within WIR
  - number of nodes: $x1 = 25, x2 = 75$
  - amount of text in logical document (number of characters): $x3 = 20, x4 = 100, x5 = 10000, x6 = 200000$
  - maximum number of nodes with incoming edges: $x7 = 5$
- ...the threshold *minval* for the minimum valuation allowed for a logical document (see Best Edges First, step 6). Within the WIR system, *minval* = 0.5 leads to good results.

Finding the Core Node

In HTML it is necessary that each logical document has one node - the core node - that defines an entry page for the user to browse the document. A core node should fulfill the following criteria:

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- All other nodes of the logical document must be reachable from the core node via links inside the logical document. So a user can browse the whole document without leaving it, starting with the core node.
- A core node should be reachable from outside the logical document. The more links point to a node from outside the logical document, the more likely it is the core node.
- Another criterion for a core node is the position of the corresponding file (the core file) in the directory tree: Typically the core file is in the same or higher directory as the other files, i.e. the more often the path of a candidate for a core file is part of the path of other files in the logical document, the more likely is it the core file.

These criteria are again modeled as fuzzy functions and then combined using methods of fuzzy logic. All nodes of a logical document are valued with this combination of functions and the best node is considered to be the core node.

Implementation, Test and Evaluation

The method described above is implemented in ANSI C, integrated into the WIR system and runs on Windows NT and Linux. We used two independent sets of HTML files to adapt and test the method:

- Set 1 is an intranet consisting of 46750 HTML files. We adapted the parameters manually for this system to get best possible results. This is also the intranet the WIR System is currently running on.
- Set 2 is an extract of 17248 HTML files of another intranet we used to test the system without adapting.

So far we don't have any objective measure to evaluate the results. For each set we manually evaluated the 50 largest logical documents and 50 logical documents randomly chosen from the remaining documents consisting of at least 2 files. We divided the results into three subjective categories good, still ok and bad. Table 3 shows the results of the evaluation described above: Row 3 and 4 show that with set 2 (no adaptation of parameters) the method has trouble with large logical documents while small logical documents are almost good. These large documents are mostly frame sets grouping articles in archives. Many of these articles don't have any relation as regards content.
On a 900 MHz PC the generation of the link graph for Set1 and Set 2 took 12:49 min resp. 3:38 min. Detecting subgraphs and core nodes took 4:44 min resp. 0:11 min.

		Good	still ok	bad
set 1 (46750 files)	Largest 50	40	8	2
	Random 50	39	6	5
set 2 (17248 files)	Largest 50	25	16	9
	Random 50	46	2	2

Table 3: Evaluation of the results

Conclusion and Future Work

This paper describes a method for grouping linked files to units we called logical documents. The method currently works for HTML files and may be adapted to other kinds of linked files. The method is quite fast and the results are good, if the parameters are adapted to the domain it runs in. Otherwise the results are still acceptable.
The method can be used within search engines or other information retrieval systems. Such a system can either handle a logical document as one document and just present the core file to the user. This works fine for small logical documents. For large logical documents the system can present an overview about the logical document and highlight or rank relevant parts. Future enhancements may include automatic adaptation of parameters based on statistical knowledge about the domain the system runs in and a better way to evaluate the results.

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Interactive Visit of a Website

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Abstract: The paper presents different possibilities for implementing a virtual guide, able to assist visitors of a web site. While the user would browse the site, the virtual guide would present him/her small videos presenting the current web page, speaking abo ut the content, the different links or the way to use the different web applications. Another possible use is to guide the visitor along a personalized guided tour, where the guide will lead him/her on one of a certain number of generated paths, presenting for example the different steps for obtaining certain results.
The paper presents two possible implementations for such an application, as well as their respective advantages and disadvantages. The complete application is currently in the final phase of development and is based upon a combination of the two different implementations identified.

1.Introduction

One of the main trends for our present day society is to generalize automatic information processing, by using new technologies, and to globalize information and communication processes, mainly by using information networks. This is known as the information or cognitive society. Within the educational process this process created new needs, offering at the same time new means to face those needs. One can notice the rise and evolution of new methods, based on various information technologies, which aim at offering an alternative instructional support, or even at replacing classical educational methods.
New educational systems should aim at preparing people to integrate themselves in a continually evolving society and a dynamic workforce (see Garito 1996). Those systems must provide people with the capacity to retrain in different other fields when the necessity for this arises. This leads to a change in the educational model, from a teacher-centered instruction to student-centered instruction. This new student-centered model encourages students to become responsible for their education and to follow individual learning paths, changing the role of teachers (instructors), who are supposed to emphasize cooperative learning and project-based activities (see Microsoft 1999). The teachers become coaches who assist students in using multimedia databases and in navigating through the knowledge available in the Internet. One person should be able to use new technological tools in order to obtain new information, to acquire useful knowledge during a re-training, that he can take whenever he/she deems suitable.
We assist lately at an expansion of the use of Intern et, with more and more servers appearing each day, each of them containing complex content. This makes difficult to find information on the Internet, and quite often inexperienced users "get lost" on the web. Big websites offer a large quantity of informat ion, containing numerous links and often not even an experienced visitor can find the desired information. It seems clear that in some cases it is necessary some sort of a virtual interactive coach, able to replace a real teacher in guiding the

visitor around a website. One cannot expect to have the assistance of a real teacher each time when he is using the Internet, but it seems reasonable to think that he might use a program that will offer similar functionality.
Most websites offering a guided tour today do that using pictures containing screen captures of the site, with different explanations. There are available tools for creating a guided visit of a site, using Real Player or Windows Media technology. Both of them offer synchronization between a video stream and web content, allowing to change the content when the video stream reaches specific points (see Bota 2001 and Real Networks 2000). However none of those techniques offer any kind of user interactivity: the first one is practically a form of a hypertext manual, while the second one can lead the user only on a specific path, without much user interaction.
The authors researched different possibilities for implementing such a virtual guide, able to assist the user. The user should be able to navigat e around, while the virtual guide will present him/her small videos of a person presenting the current web page, speaking about the content, the different links or the way to use the different web applications. Another possible use of the application shoul d allow the user to take a guided tour, where the guide will lead the user on one of a certain number of predefined paths, presenting for example the different steps for obtaining certain results. The paths do not have to be defined in advance; the application should be able to generate one specifically for the user, tailored for his/her needs. While the first approach allows a better interaction between the user and the virtual guide, the second one can be used for implementing certain learning tours on us ing web applications – e-commerce, e-banking, internet search and so on – or for guiding the user around a website, along a recommended path – virtual museum, virtual art gallery, e-learning sites–. One of the requisites of the application was to offer the possibility of use for persons using a low speed connection to the Internet.
The paper presents two possible implementations for such an application, as well as their respective advantages and disadvantages. The application is currently in the final phase of development and is based upon a combination of the two different implementations identified, in order to maintain the main advantages and surpass the possible weaknesses of the different possible approaches.

2. Framework of the application

Since most of the actual web pages are designed to be viewed optimally at a resolution of 800x600, the application was supposed to offer this space for the visualization of the web pages. Considering that beside the web page there has to be shown the video stream and some control buttons, the application uses a window of 1024x600 pixels. This allows dividing the window in three different frames, two on the left – the upper one, *video frame*, containing the video stream and the one below, *control frame*, with the control buttons – and a bigger one, *content frame*, having 800x600 pixels at the right that would contain the web pages and permit the user to normally browse the web pages.

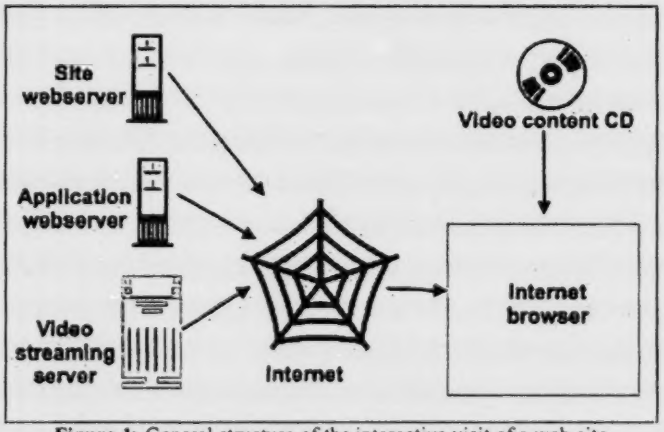

Figure 1: General structure of the interactive visit of a web site

The video streams used for the explanations are maintained in Windows Media format and are visualized with the help of the Windows Media Player. In order to offer the possibility to users connecting at lower speed to use the application a special approach on maintaining the video streams was used. Some website CDs are distributed to the users, each of them containing video files. The same video files are maintained on a video-streaming server, in order to send the video to users that do not have the CD or a specific video on their CD. The video files maintained on the server contains a multiple bit rate encoded format, in order to offer a good quality even on lower speed connections.

In order to present the user with a short video sequence specific to each web page and to allow the user to navigate around, changing the video content when the current web page is changing – usually when the user is following a link – it is necessary a way to detect the current web page and select the appropriate video sequence.

For using the application the user is accessing a web page on the CD that is automatically redirecting the user to a web application, passing as well as a parameter the version of the CD. This allows the existence of different versions for the CD containing the video files. The web application connects to a database that maintains information on the locations of the video files – both on the video streaming server and on the CDs – and allows changing the video content whenever is necessary. For each change the application looks up into the database the information for the URL of the current web page and, based on the version of the CD used by the user, is indicating either a video file on the CD or a URL for video streaming (Fig. 1). This technique allows deploying the video content to the supposed users on CD, lowering the necessary bandwidth for the video-streaming server and for the clients. The implemented version check ensure that users having an older version of the video content CD will still be able to use correctly the application.

3. Changing the video stream

In order to correctly change the video stream is necessary to know the URL of the web page currently visualized into the content frame. For detecting the current web page were identified two basic different approaches: client-side (active) and server-side (passive). The first one uses client-side scripting to actively look for a change of the visualized web page, detect and execute different actions when this event is encountered. The second one uses a server-side parser in order to modify the web pages, changing each link to point towards the parser and passing as a parameter the original link.

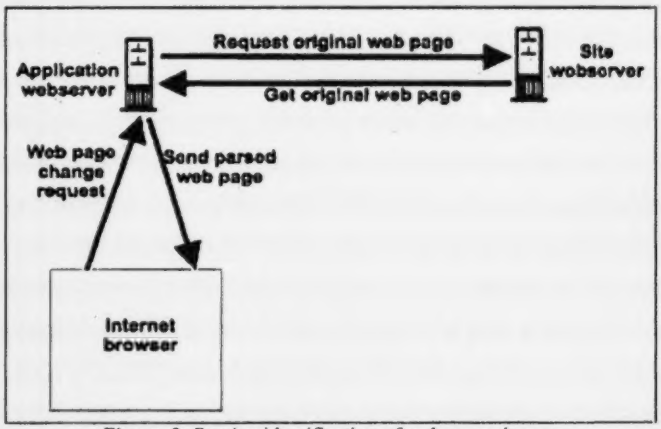

Figure 2: Passive identification of web page change

In the first case a short JavaScript code checks periodically (each two seconds) for a change into the web address of the content frame and when the page changed connect to a small web program passing the URL of the new page and the version of the used CD. It gets from the program a link to the video content that should be shown into the video frame and changes the video stream of the Windows Media Player object, in order to start playing back the desired video. The main disadvantage of this approach is due to security restrictions of JavaScript: it prevents scripts on one server to access properties of documents on a different server. This restriction is

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implemented in order to prevent scripts from fetching private data such as directory structures or user session history. In case both the script and the web page are situated on the same server this is not a problem, but if it is necessary to present video content for web pages not situated on the same server this security restriction raises a few problems: in case the pages are situated on servers of the same domain it is possible to modify the origin domain used by JavaScript for security checks to a suffix of the real domain and solve the problem. In case the domains of the web pages are completely different it is necessary to use signing techniques on both pages in order to surpass the problem. While it seems reasonable to consider that in some specific cases this could be a suitable solution – for example the pages are situated on the different national web servers of the same company –, in some other cases this is almost impossible.

The second solution is a passive one, in the sense that each time the page changes automatically a request is sent to the application, that takes appropriate actions. It uses a server-side program that modifies the web pages before sending them to the client. This means that each page shown in the content frame is obtained from the server of the application, and each link is modified in order to point to the application on the server and pass as a parameter the original link. Each time the user chooses to follow a link, the browser will send a request to the server and the application will obtain the original page, parse it in order to identify the links and modify it appropriately (Fig. 2). Below is presented an example of a small web page in the original form and respectively in the form the browser of the user gets it (Tab. 1).

```
<html>
<head>
<title>Student courses</title>
</head>
<body>
<h1>Student courses</h1>
<p>There are available for the moment the
following courses:
<ol>
<li><a  href="math.html">
        Mathematics</a></li>
<li><a href="chem.html">
        Chemistry</a></li>
<li><a href="phys.html">
        Physics</a></li>
</ol>
Please visit
<a href="http://www.yahoo.com">
        Yahoo</a> for searching more
information.
</body>
</html>
```

```
<html>
<head>
<title>Student courses</title>
</head>
<body>
<h1>Student courses</h1>
<p>There are available for the moment the following
courses:
<ol>
<li><a href="parse.php?URL=math.html">
        Mathematics</a></li>
<li><a href="parse.php?URL=chem.html">
        Chemistry</a></li>
<li><a href="parse.php?URL=phys.html">
        Physics</a></li>
</ol>
Please visit
<a href="parse.php?URL=http://www.yahoo.com ">
        Yahoo</a> for searching more
information.
</body>
</html>
```

Table 1: A simple web page before and after parsing

The program realizing the parsing (*parse.php*) maintains into the session of the client the necessary information in order to construct a complete URL (protocol, server name, port, path). This way in case the author of the web page used a relative link is possible to create a corresponding URL. The program connects to the web server that hosts the original web page, gets the web page and parses it in order to make the necessary modifications of the HTML code. At the end it sends the modified page back to the client and save the information for constructing a complete URL. The technique works fine for simple web pages, but some specific problems arise with web pages using client-side scripting to change the current web page.

In case the web page uses JavaScript or VBScript to change the current web page it becomes quite difficult to locate the links and change them adequately, since not always the links can be recognized inside the code. Although it is possible to dynamically construct a URL and change to that one the current page, most web pages do not use such techniques. This means that this kind of pages could be parsed correctly. There is a different case when the change of the current page is requested through a plug-in: Macromedia Flash, Real Player, Apple QuickTime, Microsoft Windows Media Player and others are able to generate different actions either as a response to user interaction, or at predefined times during a video playback or a animation. Since the URL for

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the new page is contained into the content requested by the plug-in, and the format is usually proprietary, it is practically impossible to change the URL on the fly in order to detect the change of the web page.
Since both approaches have specific disadvantages, probably the best solution would be to use a form based on both approaches. It would be possible this case to use the active approach to detect the changes done by problematic client-side scripting or plug-ins, if the web page is situated on the same server with the application and the passive approach for content situated on other servers or other domains.

4. Pre-defined paths

Beside the possibility to guide the used while he/she is browsing, the application can provide the user a guided visit on the Internet – of a specific site or a group of sites –. The paths can be constructed on the fly, choosing which page to present next after a specific one based on the initial user preferences, interests and so on. For example different visits can be obtained for the same virtual museum: chronological order, based on topics or other motivations.
Before starting the guided visit the application can request the user to specify certain parameters that are used to generate a personalized path for the user. In order to implement different paths is necessary to automatically change the page shown into the content frame when the video stream presenting it reaches the end. An event can be implemented into the video streams, forcing the execution of a piece of JavaScript code each time the video stream reaches a specific point – this case the end of the stream –. The code connects to the application, requesting the URLs for the next video stream and web page on the current path. The application maintains a session with information on the path followed by the user, so that it can choose the correct URLs and send them to the client. Practically the code changes the current page of the content frame to a URL pointing to the application; the browser request the page; the application generates a small web page that contains the code to change the video stream of the Windows Media Player object and to change the visualized page into the content frame.

5. Conclusions

In a simple form the presented application can be successfully used for realizing a multimedia presentation of a web site, distributing most of the band consuming content (video content) on CDs to the end users. It fits well for different companies in order to present their site to potential customers, to familiarize them with the interface and with the facilities offered through the web. It can be used by e-commerce companies to realize a description of the products, so that each time a potential buyer is visiting the page of a specific product, a video presentation of the product can be shown. Since the application supports different versions, it is possible to show a newer video for specific products, offering in this way the possibility to have a special video in case of promotions.
In a more complete form the application can be used successfully for e-learning, with a professor creating video descriptions of different sites on the Internet, and the students either browsing around and seeing the video descriptions, or taking one guided tour, personalized for their specific needs.
The authors implemented a simple form of the application and a more complete one is currently in the final stage of developing. As soon it will be finished it will be tested on a limited number of topics connected to a course of Computer Programming.

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Abstract
Is the current fascination with technology at all levels of education warranted? Are the right questions being asked before technology is implemented into the instructional process? What is the inherent danger in asking the wrong questions? If one wrongly answers the aforementioned questions, the instructional process that technology is intended to enhance will be undermined.

Robert Wauzzinski, drawing on the work of Ian Barbour (1993), describes four viewpoints towards technology – Optimist, Pessimist, Realist, and Structuralist – in *Discerning Prometheus* (2001). One's viewpoint will shape not only one's attitude towards technology but also the types of questions asked concerning the role of technology in the educational process. Drawing on the four viewpoints described by Wauzzinski, the authors will employ a Structuralist perspective in order to (1) suggest the types of questions that should be asked; (2) explore how the use of technology at the elementary level undermines students' professional and higher education experience; (3) recommend means for employing technology in the instructional process.

Introduction
Is the current fascination with technology at all levels of education warranted? Are the right questions being asked before technology is implemented in the instructional process? What is the inherent danger in asking the wrong questions? If one wrongly answers the aforementioned questions, the instructional process that technology is intended to enhance will be undermined.
(It should be noted at that out set that the authors are not Luddites. Each of them uses and employs technology as well as teaching others on its use in the instructional process.)

It is intuitively obvious that very little critical thought has taken place about the role of technology in the instructional process. Professional rags such as *Syllabus* continually hail the virtues of technology with little, if any, regard to its liability. The current rage is to "pilot" online courses. Even pilot programs, as helpful as they may be, still fail to ask the right questions. Robert Wauzzinski, drawing on the work of Ian Barbour (1993), describes four viewpoints towards technology – Optimist, Pessimist, Realist, and Structuralist – in *Discerning Prometheus* (2001). One's viewpoint will shape not only one's attitude towards technology but also the types of questions asked concerning the role of technology in the educational process. Drawing on the four viewpoints described by Wauzzinski, the authors will employ a Structuralist perspective in order to (1) suggest the types of questions that should be asked; (2) explore how the use of technology at the elementary level undermines students' professional and higher education experience; (3) recommend means for employing technology in the instructional process.

In order to put the intent of this paper into perspective it is necessary to provide an overview of Wauzzinski's four viewpoints. We would encourage you to reflect on these categories as they relate to your understanding of the role and place of technology in the educational process. In addition it should be noted that even though one perspective may best describe your attitude towards technology that there is no guarantee it will be employed in the decision making process.

The first viewpoint is the technological **optimist**. The technological **optimist** believes that technology is neutral or value-free. This viewpoint is rooted in a thorough commitment to the autonomy of human reason and an unwavering commitment to the inevitability of progress. The future is always a projection of the good of the present. Human beings are seen as technological innovators; technology should be developed for the betterment of all. (Wauzzinski, 2001) From this vantage point it is only through the employment of technology that all our educational woes will be eventually solved. The **optimists** believe that all schools must be networked and comprehensively employ computers throughout the curriculum. The "benefits" are hailed; questions regarding the liability are not adequately considered or ignored.

The technological **pessimist** believes that technology is inherently evil because it compromises human freedom and that the problems created by technology are insurmountable. The technological **pessimist** would argue that employing technology in the instructional process would ultimately destroy it. One of the ways this has taken place is by emphasizing its "entertainment" value.

The technological **realist** using Reason attempts to view technology from a cost-benefit perspective. The **Realist**, lousing risk assessment, attempts to maximize the benefits and limits the consequences of employing technology. The **Realist** acknowledges that there is always a "trade-off" involved. This perspective will often seek a technological solution to problems encountered and thus is often in danger slipping into the **optimistic** viewpoint.

The technological **structuralist** attempts to view life holistically and believes that technology should complement the whole of life. Technology is considered good by the **structuralist** but often distorted. The **structuralist** attempts to wrestle with the role and place of technology as it relates to all of life. They also believe that technology will play a different role depending on its context. In other words, families are not businesses and thus technology's role will be different in a family than in a business. The Structuralist would ask, "What is education?"; "What does it mean to educate?" The **structuralist** acknowledges that technology shapes those who employ it.

The **structuralist** perspective offers the greatest promise for those willing to wrestle with both the potential benefits and liabilities of employing instructional technology. Please note, the liabilities have not generally been wrestled with until after the technology has been implemented. Sherry Turkle (1997), the MIT sociologist of technology, notes that we have "made a mistake in not discussing ethical and moral issues of technologies before the technology is upon us." Two observations are in order (1) Asking hard

questions about the role and place of instructional technology is hard work; (2) Not asking the questions explicitly is not an option, too much is at stake.

Asking the Right Type of Questions

There are five fundamental questions that must be posed before one even begins to consider the use of instructional technology. They are:

These questions are complex and difficult to answer. Adrian Dupuis in *Philosophy of Education In Historical Perspective* notes that the lack of an agreed upon definition of education makes educational reform impossible because no one knows what they are actually reforming because for "the most part they repeat, sometimes in different words, the clichés of decades ago." (1985) In spite of the challenge the above-mentioned questions cannot be ignored.

For example, I [DG] find PowerPoint to be a helpful tool in organizing and preparing lecture notes. I also find it helpful, sometimes, as a visual aid when lecturing. In general, I find it to be a straightjacket when used in the classroom. PowerPoint enslaves one to a particular order; it robs one of flexibility and sucks the dynamism out of the student-teacher relationship. It focuses student attention on "getting the data" rather than tracking with larger themes and questions posed by the material. And though the handouts produced are helpful, students become enslaved – more concerned with what slide one is on rather than the larger themes and questions posed by the material.

Instructional technology is not the guilty party. It is the educators who see it a panacea for addressing the current educational crisis – whether real or perceived. The hard questions are only beginning to be asked, and the real issues addressed. The virtual world is not the same as the real world. Virtual relationships are not the same as real relationships. Painting on the screen is not the same as finger-painting on butcher paper. It is not an inadequate substitute.

The hard questions must be asked. If technology is not properly employed, the results will be disastrous and the educational process and establishment will be further undermined. Raising the hard questions does not make one a naysayer; it stimulates one's thinking about instructional technology and how it might complement the educational process rather than undermine it.

Now that we have suggested the types of questions that should be asked our attention will turn to how the use of instructional technology at the elementary level serves to undermine the students' professional and higher education experience.

Technology in the Elementary Context

What is the definition of education and what are the effects of the computer on the developmental, behavioral, and physical needs of children? Experts (Kelly, 2000) are beginning to speak out against early computer use. They say that too much use, too early, "may actually undermine the development of the critical skills that kids need to become successful, diminishing creativity and imagination, motivation, attention spans, and the desire to persevere" (Kelly, 2000).

What is the definition of education and what are the effects of the computer on the developmental, behavioral, and physical needs of children? Experts (Kelly, 2000) are beginning to speak out against early computer use. They say that too much use, too early, "may actually undermine the development of the critical skills that kids need to become successful, diminishing creativity and imagination, motivation, attention spans, and the desire to persevere". (Kelly, 2000). states that it is his belief that knowledge is the development of children's capacities in ways that enable them to become active and constructive participants in the life of society. Anne Alpert, principal, says that she can tell from afar which of the younger students are home-computer users and which are computer-free. The computer users are less inclined to take the small risks that build competence and creativity and more likely to have trouble negotiating the politics of the playground. The computer-free students, who spend hours doing old-fashioned activities like playing dress-up and reading books, are social and outgoing, curious, and work well in groups.

What is knowledge and how does the computer fit into the development of skills children will carry with them through the rest of their lives i.e. language and socialization, the ability to organize thoughts, the concept of cause and effect, problem-solving, creativity, imagination, self-motivation, and self-confidence? There are many theories/philosophies concerning knowledge, but if we consider how knowledge relates to conduct, Dewey (1916) contends that knowledge that does not affect conduct is of little or no value. In his essay "My Pedagogic Creed," published in 1897, he How do people learn and how does the computer fit into the essential learning, which requires experience, experimentation, reflection, and hands-on observation?

What is the nature of the teaching-learning process and how does the two-dimensional format of computers fit into the child's "real world"?

What is the role of the teacher/instructor in the process? Sherry Turkle states, "Too much of the time we think the computer is supposed to do it all, and we don't really appreciate how important the people are…It's the computer plus the human environment around the computer that matters."

Conclusion:

There is scant evidence that computers teach basic skills any better than traditional methods, or that children who don't have computers are somehow "left behind." Conversely, there is abundant evidence that an uncritical infatuation with computers as an educational panacea is replacing skill building and learning with formless play while forcing art and music lessons, and in some cases math textbooks, off many school budgets. (Healy, 1999)

Longtime educator and administrator, Healy is actually a fan of computers. But she is dismayed that so many people in and out of education hold the almost religious conviction that computers in classrooms equal better learning experiences. Making children computer literate, she argues, in no way guarantees they will develop the cognitive skills they need. In fact, she presents much evidence that computers can help children disconnect intellectually, emotionally, and socially. When examining Childs Growing Mind, 1990., who contends that, in our fervor to embrace computers, we have overlooked their potential to harm youth, particularly young children. Drawing on extensive interviews with school administrators, teachers, parents, and children themselves, Healy concludes that the problems caused by excessive computer use are staggering: Among regular users, for example, visual impairment is now the norm, and hard- core cyberchildren, lacking sufficient physical exercise, as a result also grow up less fit mentally than their parents. Even more disturbing is the potential impact on brain development, since the processes of thinking aloud, questioning, creative problem-solving, and communicating will be inevitably downplayed by those who rely on computers to process data. Despite the shrill alarm she sounds, Healy doesn't dismiss computers outright, and she maintains that, used moderately and guardedly, they can enrich young people's lives:

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When 125 ``at-risk" students in New York City were given home computers with online hookups, for example, Internet-research began to substitute for television viewing and severely withdrawn pupils began to communicate with one another online. For in-school use, the perfect model, in Healy's view, is the Gold River Discovery School outside Sacramento, Calif. Here, students who use computers are ``continually coached on how to take responsibility and reflect on their learning." Hands-on learning always precedes computer use, and virtual reality is never allowed to take the place of genuine experience. Throughout, Healy intersperses her assessment with p ractical advice: She urges parents and educators to be wary of software that is overly stimulating to the senses alone, to avoid programs that give ``rewards" for completing tasks, and to be on guard that children don't avoid playing with friends in favor of spending more time interacting with their computers. A timely and sensible challenge to the prevalent notion that computers necessarily enhance mental development and learning.

SOME FINAL QUESTIONS:

* When should children start using computers?
* How should schools incorporate computer use into their curriculum?
* Which types of computer software programs should be avoided?
* Are children who don't have computers in class and at home doomed to fall behind their peers?

Designing a Collaboration Environment for Teleworkers

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Abstract: Teleworking enables a more flexible scheduling of working time and places of work on the way to the modern information society. The rapid development of cooperative application software and electronic networking systems such as Internet and the penetration of web-based applications have demonstrated the enormous potential of technical facilities for new employment models. This paper defines requirements for an effective and flexible collaborative environment supporting coupled work scenarios for teleworking. An important feature of such an environment is to support synchronous collaboration with audio/videoconferencing and data and application sharing between distributed teleworkers. New communicative and collaborative software solutions are preconditions for such scenarios. The article points out the deficits of existing applications and suggest a solution for a meeting point for teleworkers based on our experiences with teleworking in the context of the intermobil project.

Introduction

A number of factors are driving the growth in teleworking. Teleworking is an industry trend that addresses not only business issues but also provides tangible "quality of life" gains for the workforce at large. Teleworking offers a company access to a broader base of qualified employees and reduces corporate overhead in real estate and related expenses. So a "real time" work environment with immediate access anytime, anywhere to corporate information sources can be created. Teleworking may also offer the opportunity for workers to have more choice in terms of where they work and live. As the teleworking trend emerges and evolves, it will ultimately change the current definition of "the workplace". The flexibility of teleworking can offer wide-ranging, powerful business solutions. In our project work we focus at a special kind of teleworking - Telecommuting, where the teleworker variable commute between office and home workplace. Also called alternating teleworking is surely the mostly used form of teleworking because it combines the advantages of teamwork in an office with the flexibility of homework.

Problem Description

To tide over the local distribution teleworkers can interact with others by text based communication like instant messaging or chat and finally by an audio/video conference with application and data sharing. At the different working locations they can be connected with the internet via Ethernet, ADSL, ISDN or analog modem. If their work requires cooperation with other team members the following problems can be detected:

- it is often unknown, on which place the teleworker operates at the moment and which communication tools he could use (depending on the available equipment of the working place like video cameras etc.)
- simultaneous communication with several teleworkers requires a very high co-ordination effort using different other telecommunication channels like email or telephone before the properly collaboration can start

Requirements to a collaboration environment for teleworkers

If all teleworkers are equiped with the necessary infrastructure (Internet binding) and required hard and software, theoretically each teleworker can initiate a video conference with each other teleworker. But the teleworker has to know:

- whether the communication partner is linked over the network at all
- which communication tools he could use (video camera, microphone, etc.)
- the IP address of the computer of the communication partner

So it is necessary to communicate over other telecommunication channels like email or telephone to get this information before the real collaboration can start. The communication partners notify their current position over this channel by transmitting their IP addresses and the tools they want to use. The main requirement for a

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collaboration environment is to provide this necessary information for all teleworkers. For this purpose the following requests exist:

- the collaboration environment can be used from any workstation which is connected to the internet
- each Teleworker can detect immediately who is reachable at the moment
- he can choose a communication tool to collaborate immediately with any team member without the assistance of other communication channels

Initial stage for solution

For managing the communication relations between the distributed partners a meeting point for working groups is needed. Such an application can use the mechanism of a directory service on a central system which is always reachable under the same network address. Such directory services already exist at the market but they provide countless functionalities which are not necessary for an effective application. For effective collaboration systems are required, which provide only the absolutely necessary functions and are fast and simply controllable by the user. For this reason an server system is needed, which takes over the functions of a communication head office. This server application has to provide the following functions:

- receive and store the communication parameters (IP addresses, status etc..) of each teleworker
- publish the current communication parameters of all Teleworker
- administration, release and blocking of the provided collaboration services like multipoint video conference system (MCU) or document sharing

The Client of the collaboration system at the teleworkers side should support the following functions:

- cyclic transfer of the communication parameters to the head office
- starting a collaboration session e.g. a video conference to one or more team members using the communication parameters provides by the meeting point

Implementation

An solution for this problem can be a web-based client-server-system which integrates several collaboration tools. The client logs on at the server and send frequently his parameters over a special TCP-Port to the server. The server application use a central database to store and manage the communication parameters of all teleworkers. If the server won't receive any data from the client, he will send an request of acknowledgement and then mark the teleworker as logged out from the system. This type of session management facilities might be enough to control the participated teleworkers. Using a html-form the teleworker can request the communication parameters and status of any other team member logged on at the system. For easier handling the solution should integrate several collaboration tools e.g. as COM+-applications like NetMeeting. At the client-side ActiveX controls can be used for starting the communication applications directly from an WWW browser site. At the moment we are developing and testing several implementations based on the explained concept.

Conclusion and future work

Related work shows that the new dimension of coupled work in teleworking scenarios becomes more and more important and that tools already exist to support synchronous communication. But the requirement of a general-purpose environment supporting effective and flexible collaboration between mobile and location independent teleworkers is not fulfilled by these systems. Therefor we defined the requirements to an collaborative environment for teleworkers and developed an universal solution for a meeting point. Implementation and testing of the applications under practical conditions are now in progress. We are planning to improve the interface between these services and others and to integrate more various collaboration applications.

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Using The Balanced Inventory of Desirable Responding to Determine Accuracy of Self-Reporting Instruments: Web-Based Vs. Paper and Pencil

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Along with the World Wide Web's growth as a means of disseminating information it has also become a poplar and economical means of gathering information. This ongoing study attempts to determine the efficacy of the World Wide Web as a data gathering instrument by comparing students' responses to similar Web-Based and Paper-Based survey instruments. This paper describes in detail an ongoing study in which graduate students at a major southeastern university were given a combination of paper-based and web-based survey instruments that measured the likelihood that they would provide accurate responses to a number of questions. At the end of the study a repeated measures statistical analysis will be conducted to determine the efficacy of the web-based versus the paper-based instrument.

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Effects of Direct Vs. Non-direct Instruction In a Teacher Preparation Technology Class

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Abstract: This paper describes a study that is currently under way to determine the efficacy of direct versus non-direct instruction in a teacher preparation technology class. The study will examine five sections of the target class. During the first week all students will receive a pre-test and a motivation assessment. Both classes will be conducted using the same instructional techniques until the last third of the course when one module will be modified. Three of the sections will receive indirect instruction while the other two will receive direct instruction. A posttest will be administered to all of the sections. Once all data are collected, researchers will produce descriptive statistics to show the means and standard deviations of students' scores on the PCM instrument, MSLQ, and achievement test. Two 2x2 ANOVAs will be calculated to evaluate the hypothesized interactions. Follow-up analyses will be performed as needed to evaluate differences between cell means.

Introduction

This paper describes a study that is currently under way to determine the efficacy of direct versus non-direct instruction in a teacher preparation technology class. Given the number of technology related teacher preparation classes currently being offered in colleges of education across the country the need to determine and describe effective instructional strategies is of the utmost importance. This study will examine the effects of students' conceptual levels and teachers' instructional strategies on students' motivation and achievement in a computer technology course. In this paper the conduct of the study will be described.

Participants

UNC Charlotte undergraduate, post-baccalaureate, and graduate students enrolled in EIST 4100/5100, an introductory computer technology course, will participate in this study.

Procedures

Five sections (3 sections during spring 2001 and 2 sections during first summer session 2001) of relatively equal size will be taught by either direct instruction or non-direct instruction

During the first class, students will be given approximately twenty minutes to complete the Paragraph Completion Method (PCM) instrument (Hunt, Butler, Noy, & Rosser, 1978) for assessing conceptual level. This instrument instructs students to write at least three sentences in response to a series of items that indicate how a person handles conflict and uncertainty and how that person thinks about role structure and authority. The manner in which a person completes the sentences indicates that person's level of conceptual complexity. Scores may range from "0" (i.e., no conceptual complexity) to "3" (i.e., maximum conceptual complexity). Individuals with high scores tend to show fewer tendencies to engage in bifurcated thinking, greater independence of judgment, greater tolerance of ambiguity, and greater ability to integrate different perspectives than individuals having low scores.

During the second class of week #1, all students will be pretested using the "Basic Technology Competency for Educators" instrument (Flowers, Antonak, & Algozzine, 1997) -- a self-report of basic technology skills -- to assess the equivalence of the sections on technology skills. We anticipate no statistically significant differences ($p > .05$) between the direct and nondirect instruction sections on perceived technology competencies.

The first two-thirds of all classes will be taught in a similar manner using published study guides. However, during the last third of the class, while teaching their students to synthesize and apply the material learned previously during the course, one instructor will use direct instruction in his section and the second instructor will use nondirect instruction in his sections.

Direct and non-direct instruction will be implemented using Cicchelli's (1983) Instruction Pattern Observation Instrument. The instrument describes instruction as direct if the professor: (a) is the dominant leader who establishes and enforces rules in the classroom; (b) structures learning tasks and establishes the time and method for task completion; (c) states, explains, and models the lesson objectives and actively maintains student on-task involvement; (d) responds to students through direct, right/wrong feedback, uses prompts and cues, and if necessary, provides correct answers; (e) asks primarily direct, recall-recognition questions and few inferential questions; (f) summarizes frequently during and at the conclusion of a lesson; and (g) signals transitions between lesson points and topic areas.

The instrument describes instruction as non-direct if: (a) professors are a catalyst or helper to students who establish and enforce their own rules; (b) students are allowed to select the learning task and the manner and order in which it is completed; (c) students are presented with examples of the content to be learned and are encouraged to identify the rule of behavior embedded in the content; (d) professors respond to student work through neutral feedback and encourage students to provide alternative/additional responses; (e) professors ask mostly divergent questions and few recall questions; (f) students are encouraged to summarize and review important lesson objectives throughout the lesson and at the conclusion of the activity; (g) students are encouraged to choose new activities in the session and select different topics for study; and (h) students signal their readiness for transition to the next learning set.

Applying the principles of direct instruction, the first instructor will use prepared scripts to teach during the final third of the class. These scripts will establish all the class rules, all the learning tasks and objectives, and the final product to be created. The instructor will remain the focal point of all instruction. Applying the principles of nondirect instruction, the second instructor will introduce the material to the students and establish broad parameters in which the students may work during the final third of the course. Students will determine the lessons' objectives and goals, identify the important procedures of the course, and take primary responsibility for their own final products.

At the end of the course, students' motivation to learn in the course will be assessed using the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, & McKeachie, 1991). The MSLQ is a 31-item, self-report instrument that may be used to assess college students' motivation to learn in the classroom. Students usually take approximately fifteen minutes to complete the MSLQ.

Following administration of MSLQ at the end of the first class of week #16, students' achievement during weeks #14 to #16 will be measured using a professor-made, performance-based test. The test will require students to produce an electronic product that incorporates many of the tasks taught during the previous weeks. A total of about 20 features will be expected in each student's product. Points will be assigned when the features were present. Students will be given approximately fifteen minutes to complete this test.

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Once all data are collected, researchers will produce descriptive statistics to show the means and standard deviations of students' scores on the PCM instrument, MSLQ, and achievement test. Two 2x2 ANOVAs will be calculated to evaluate the hypothesized interactions. Follow-up analyses will be performed as needed to evaluate differences between cell means.

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Community Colleges World Wide Web Home Pages: Accessibility and Design

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Abstract: The Carl D. Perkins Vocational and Technical Education Act of 1998 made the community colleges the point of access for training and education for special populations. Physical barriers are obvious problems that limit access for individuals with disabilities, and community colleges have made reasonable accommodations for individuals with disabilities. However, there are on-line barriers that limit Web-based content that have often been overlooked. This study examined the content accessibility of community college home pages. A total of 253 community college home pages were evaluated for content accessibility. Only 22.1% of the community college home pages were accessible to individuals with disabilities.

Introduction

Access and opportunity have become the hallmarks of post-secondary education. The community college extends far beyond the traditional, limited freshmen-sophomore experience and provides a setting where almost anyone can learn (Parlinchak, 1998). Community colleges serve all citizens and provide a range of services that support special populations. As the number of students continues to increase, especially among special populations, so does the need for support programs and services.

The Americans with Disabilities Act (ADA) of 1990 provides the same civil rights protection to individuals with disabilities that apply as a result of race, gender, national origin, and religion (Button & Wobschall, 1994). Title III of the ADA directs that public facilities make reasonable modifications to control discrimination and support accessibility in policies, practices, and procedures (Council for Exceptional Children, 1994). As a result of this landmark legislation, accessibility alterations such as providing ramps to elevated areas and providing accessible signage through height adjustments and raised lettering have become commonplace across the United States.

The Perkins Vocational Act of 1984 called attention to America's need to support individuals who were less fortunate by birth or economic circumstances. The Act underscored the need for improving vocational programs and serving special populations of students. The Act created an awareness of the population of people that had gone unnoticed with little or no training. This Act made community colleges the point of access for training and education for special populations.

The World Wide Web (WWW) has become an invaluable resource for many people with disabilities. Accessibility across platforms and geographic distance makes the WWW an ideal universal tool for gathering and disseminating information (Heflich & Edyburn, 1998). In fact, it is estimated that 34.4% of community colleges use the Internet to disseminate training and educational programs to special populations (Gibson, 2000). Wong (1997) discussed using the Internet for increased self-advocacy by individuals with physical impairments. It is ironic, however, that while technological developments have enhanced and provided new exciting opportunities for the WWW, they have, at the same time, comp licated and limited the accessibility of the content and resources for individuals with disabilities.

Physical barriers are obvious accessibility concerns. Web page developers need to be just as aware that on-line barriers can create significant problems for some users. The Americans with Disabilities Act requires that all organizations make reasonable accommodations for individuals with disabilities. Even though there has not been a judicial ruling on WWW accommodations for individuals with disabilities, home page developers should work towards designing and building Web sites that are accessible to all individuals. It is important that Web page developers use and follow standards that allow accessibility to all WWW users.

A variety of disabilities can reduce accessibility to the WWW. Visual, hearing, movement, cognitive, speech, and other impairments can limit availability of information. Assisted technologies or accessibility aids, such as Braille output systems, keyboard modification, screen enlargement utilities, voice output utilities, and other technologies allow individuals with disabilities to access information on the WWW. However, because of the complexity of many Internet resources, some information cannot be accessed with these aids. Developers of accessibility aids continue to identify and develop features that can overcome some of these barriers, but there are many simple strategies that Web page developers can use with very little effort that would make their services more accessible.

The Trace Research and Development Center at the University of Wisconsin at Madison produced the *Unified Web Site Accessibility Guidelines* (Trace Research and Development Center, 1998). This information was transferred to the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) and used to produce the *Web Content Accessibility Guidelines 1.0* (Chisholm & Vanderheiden, 1999a). The primary goal of the guidelines is to promote content accessibility. The guidelines do not discourage content developers from using images, video, and other multimedia tools; rather, they explain how to make multimedia content more accessible to a wide audience.

The *Web Content Accessibility Guidelines 1.0* (Chisholm & Vanderheiden, 1999a) is organized around two general themes and 14 guidelines or general principles of accessible design. The themes are (a) ensuring graceful transformation and (b) making content understandable and navigable. The document provides the rationale behind the guidelines and includes some groups of users who benefit when they are applied to Web pages. In addition, a list of checkpoints is provided that explains how the guidelines apply to typical content development scenarios. Each checkpoint is specific enough to be verified, while general enough to allow Web developers freedom to use appropriate strategies.

The guidelines that primarily address the theme of ensuring graceful transformation, Guidelines 1 through 11, assist Web page developers in producing sites that remain accessible despite constraints confronted by people with disabilities. For example, Guideline 1 states that Web developers should provide equivalent alternatives to auditory and visual content. Text can be rendered in ways that are available to almost all browsing devices and accessible to all users, but auditory and visual content are not. Guidelines 12 through 14 primarily address the theme of making content understandable and navigable. This includes providing navigation tools and orientation information in pages with maximize accessibility and usability. Not all users can make use of visual clues such as image maps or graphical information, but with orientation information, users can understand many of these graphical images. The *Web Content Accessibility Guidelines 1.0* document provides much more detail in developing content accessible Web pages (Chisholm & Vanderheiden, 1999a).

Building Web sites that comply with standards for accessibility should be a high priority for Web page developers. To date, little research has documented the extent to which accessibility goals have been reached. The purpose of this study is to examine the accessibility of community college home pages and provide information on making them accessible (if they are not) to individuals with disabilities.

Method

To examine the accessibility of community college home pages a descriptive study was conducted. The sampling technique used to select community college Web sites and the evaluation procedures are discussed in the following section.

Sampling

The population Web sites for this study was community colleges located in the United States. A list of 720 community college Web sites was generated using the search engine *go.com* (2000). A random sample of 260 community college home pages was selected for content accessibility evaluation in this study.

Procedures

Each home page was analyzed using the software package *Bobby 3.2* (Center for Applied Special Technology, 2000), which allows researchers and other professionals to evaluate Web pages in accordance with the W3C Web Accessibility Initiative's guidelines. *Bobby 3.2* produces a summary report that consists of (a) the number of Priority 1, Priority 2, and Priority 3 access errors, (b) user check data, (c) the types of accessibility errors, and (d) the ease in correcting the accessibility error. Priority 1access errors are problems that seriously affect the page's usability by people with disabilities and the Center for Applied Special Technology (CAST) strongly suggest that Web developer correct these errors. For a page to obtain Bobby Approved rating, the home page cannot contain any Priority 1 errors. Priority 2 access errors are considered important for access but are not as vital as Priority 1. Priority 3 access errors are third-tier access problems that a Web developer should consider correcting.

Some accessibility errors cannot be confirmed using *Bobby 3.2*, but *Bobby 3.2* provides user check data that informs the user that manual examination and human judgment are required for examining a specific area of the home page. For example, when different font colors are detected, *Bobby 3.2* identifies multiple color fonts and reports this as a user check, meaning that it may potentially be an accessibility problem. In this study the user check data was not manually examined but will be reported as potential accessibility problems.

For a full description of the types of access errors see the *Techniques for Web Content Accessibility Guidelines 1.0* (Chisholm & Vanderheiden, 1999b). In this study only the initial home page was evaluated; that is, no links from the home page within the domain were evaluated. Scores for each home page were tabulated and further analyzed.

Results

Of the 260 community college home pages randomly selected for this study, only 253 pages were available for evaluation. Approximately three-fourths (77.1%) of the home pages (n=195) were not approved by *Bobby 3.2* (2000) as content accessible. This indicates that at least one Priority 1 error (seriously affects accessibility) was detected on these pages. There was an average of 1.01 Priority 1 accessibility errors on the community college home pages. In addition, the average number of potential Priority 1 accessibility errors was 8.48.

There were three types of Priority 1 accessibility errors detected on the home pages. Most of the community college home pages (64.2%) did not provide alternative text for all images. A few of the home pages did not provide alternative text for image map hot-spots (17.3%) and did not provide alternative text for each applet (5.5%). All the Priority 1 accessibility errors were rated as easy to correct.

Almost all the home pages (99.2%) did not identify the language of the text. Approximately 90% of all community colleges home pages (a) did not specify a logical tab order among form controls, links, and object, (b) did not provide keyboard shortcuts to links, (c) did not provide a descriptive title to links, and (d) used deprecated (i.e., included elements that have been replaced by newer elements) language features. Using tables in home pages create additional types of accessibility problems. Community college home pages used tables to format text documents in columns (77.2%), did not provide a linear text alternative for tables (81.9%), and did not provide a summary and caption for tables (77.6%). Many of the home pages used movement in their images (78.7%).

Using color on home pages can create problems in differentiating items on the page. Most of the pages needed examining for foreground and background colors contrast (92.1%) and used color fonts to convey information (87.4%). The majority of sites did not use an extended description to convey information beyond what was in the alternative text (84.2%). Again, the inclusion of tables on home pages could create potential accessibility problems. Most of the home pages needed to be examined for the use of structural markup to identify their hierarchy and relationship (80.7%) and examined for the presence of headers for the table rows and columns (72.4%). When scripts are used to convey information or functionality, alternative content needs to be provided (54.3%).

Discussion

Community colleges have played an important role in the training and education of individuals with disabilities. This study provides empirical evidence that most community college home pages are not accessible to individuals with disabilities. With very little effort all the home pages could easily be corrected to eliminate the more severe Priority 1 accessibility errors.

Web developers at community colleges need to examine their Web sites for accessibility problems. It is strongly recommended that validation methods be used in the early stages of Web development, which will help make problems easier to correct and assist developers in avoiding many accessibility problems. There are two suggested methods of validating a Web page for accessibility (Chisholm & Vanderheiden, 1999a). First, automatic tools are available for scanning the site and providing data. Bobby and other validation services should be used to provide information concerning accessibility problems. Automatic tools are convenient but do not identify all accessibility issues, therefore it is recommended that each site be examined by a knowledgeable individual and individuals with disabilities to ensure clarity of language and ease of navigation. The processes of rapid prototyping and formative evaluation have been used for many years to help develop educational software and have recently proven to be useful in the process of Web site development (Corry, Frick, & Hansen, 1997). Expert and novice users with disabilities should be invited to view home pages and provide feedback about accessibility or usability problems and their severity.

Community colleges are leaders in educating special populations. The WWW has become an invaluable resource for notifying special population students of services available at their institution. Creating home pages that are accessible to a diverse group of users would insure the universality of the WWW.

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Improving the Performance of CBIR Systems through global Application of User Feedback

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Abstract: This paper introduces a framework that aims at resolving some of the problems CBIR-systems are facing, especially the problem of lacking semantical information from visual primitives. The goal is an improvement of the quality of result sets. This is achieved by making use of user feedback to cluster images into different thematic groups and the global use of feedback (instead of just session-based use of feedback). The framework is designed to be usable with any CBIR system, since it is implemented as an interface between user and system. Evaluation results of a prototypical implementation are given.

Introduction

Content-based image retrieval is receiving much attention because of the ever growing amount of images available in digital formats. Many of these images are not supplied with metadata so that there is no possibility to query the collection using customary techniques. The cost needed to provide a document with descriptive metadata is on average 3.63 $ US according to [Roderick 1999]. This average holds for images too, since an adequate and encompassing description of an image needs at least as much time as writing a summary for a text document.
CBIR is an alternative to the expensive creation of textual metadata. CBIR systems usually compute a *signature* comprising of the values for a varying set of *automatically* extractable features for each image. These features typically include color histogram and texture data or shapes easily recognizable in the images. Because these features make no assumptions about semantics they are often called *visual primitives*. Only the signatures are compared in the course of a query to the system.

The biggest problem of today's CBIR systems is the *semantic gap*. This name outlines the fundamental problem inherent in the use of visual primitives. Depending on the actual weights and features used in a query, images with differing semantics can appear to be very similar when compared according solely to their signatures. See (Fig.) for an example.
In order to improve the quality of responses to queries, many schemes have been proposed, ranging from classical techniques from text retrieval like relevance feedback or term re-weighting schemes [Squire et al. 1999] to the application of special forms of neural networks [Woods et al. 1998]. An extensive overview of CBIR systems in existence can be found in a technical report of the university of Utrecht [Veltkamp et al. 2000]. Many of these approaches depend on user feedback on the quality of the results, since human perception is far superior to computers at the task of identification of image contents. But nearly all of these systems discard of the information given by the users after their respective queries have been processed instead of using it in order to improve on the overall quality of the responses of the CBIR system.
The approach presented in this paper utilizes user feedback to its full extent in order to improve the results for future queries as well.

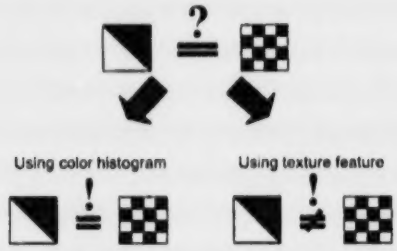

Figure 1: Example for different results using different features when comparing the same two images

The Approach

The approach has to satisfy several requirements: The main requirement is independence from any specific CBIR system, since the approach is supposed to be used as an addition to an already existing information system. In order to provide a stable service it needs to be independent of features that could become deprecated in a new release of the CBIR system used. Since the composition of the signatures is often a trade secret of the vendor, the approach has to build its own data structures that keep score of modifications to the data.
These requirements suggested the best way to implement the approach, namely as an interface between user and CBIR system through which all communications are conducted. This additionally allowed for a better encapsulation of the underlying system so that changes in the information system do not influence use of the system.

Since automatic clustering using the CBIR system is out of the question (because of the high error margin) the approach introduces the concept of thematical groups. A group is built around a common distinguishing feature. Users may be allowed to create their own groups or alternatively the groups can be pre-created by the maintainers of the system. The creation of a group is a straightforward process: They are created through a simple CBIR query complete with an example image and the results and especially the parameters of the query are saved. Additionally, these groups contain two membership lists, the *hotlist* and the *coldlist*. The *hotlist* contains all images that are relevant results, while the *coldlist* consists of the mismatches.
To which of these lists an image of the group belongs depends on the value of one parameter, λ, with $\lambda \in [0,1]$. Values of $\lambda \leq 0.5$ gain the image inclusion in the *hotlist*, while images with $\lambda > 0.5$ are considered part of the *coldlist*. New members of the group start with an initial value of $\lambda = 0.5$, so that in new groups initially all images belong to the *hotlist*, because of lacking information to the contrary. Since this process depends solely on the CBIR system, mismatches may very well occur. But that is not a problem, mismatches will be taken care of during the life cycle of the group.

A query using groups is processed as follows:
The parameters of the query are given to the underlying CBIR system, which performs a normal query on the database. The results from this query are then analyzed by the interfaced. The ratings for images belonging to the group in question are modified according to these rules:

1. Let r be the rating the image received from the CBIR system.
2. Let m= $min(r, 100 - r)$
3. Let r'= $r - m + 2 * m * \lambda$

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Step 2. is necessary since the approach uses its own scale on which similarity is measured. This is done to ensure independence from vendors. A rating of 0 means complete congruence to the example, whereas a rating of 100 stands for complete dissimilarity. the variable **m** denotes the radius of the biggest interval having **r** as midpoint and being entirely inside the interval [0,100]. Step 3. then computes the new rating for the image by multiplying the size of the interval (2 times **m**) by λ and adding that value to the value of the left edge of the interval. This step gives images from the *hotlist* a better rating while images from the *coldlist* are punished.
After all of the results have been processed, the threshold is applied to the modified result set. Only the images satisfying the threshold are then presented to the user.

The presentation of the results includes the possibility to give feedback on the images. Positive feedback indicates that the image is a relevant image for the group that was selected at the start of the query (and vice versa for negative feedback). The feedback is used to modify the value of λ. If an image is rated and is not a member of the group in question, this image is added to the *hotlist* of the group with $\lambda = 0.5$ regardless of the type of feedback it received. If an image is already part of the group, λ is actualized differently depending on the type of feedback:

positive feedback $f^+(\lambda) = 1 - \sqrt[s]{1-\lambda^s}, \lambda \in [0,1], s > 1$

negative feedback $\lambda' = f^-(\lambda) = \sqrt[s]{1-(1-\lambda)^s}, \lambda \in [0,1], s > 1$

These two functions effect the necessary modifications on the parameter λ. Negative feedback causes the parameter to grow whereas positive feedback lessens it. The additional parameter **s** that is introduced in these functions allows scaling of the impact of one piece of feedback in relation to the size of the expected user basis. In a system with named users or a highly specialized environment the possibility of wantonly false feedback is relatively small. Thus greater trust can be placed in the users. Considering a bigger audience, e.g. a search-engine on the WWW, the possibility of abuse is much higher, so less trust is put into individual ratings. This makes **s** effectively a gauge for the trustworthiness of the users. The smaller the value for **s**, the bigger the impact of individual ratings on the new value of λ.

These are the parts that build the framework. As can be seen, no assumptions are made about special features of specific CBIR systems. The approach only uses the ratings that are generated by the underlying image retrieval engine. These ratings need to be converted into the internally used scale. The scale transformations and the user interface are the only parts that need to be changed in order to adapt to a new CBIR system, allowing for rapid development of the application and full reusability of data collected with the previous system.

Results of an Evaluation

In order to evaluate the approach outlined in section a prototype (called GIVBAC) has been implemented and tested against an image database consisting of about 1500 images. GIVBAC is designed to be an interface to Virage Search Engine included in the InterMedia-cartridge of Oracle 8i. This engine uses four different features, namely global color, local color, texture and shape, which may be accompanied with weights defining their importance and a threshold that defines the maximally allowed difference to the example, measured on a scale from 0 to 100. The evaluation consisted of five performance tests, each one measuring the changes in performance for one particular thematic group of images. The members of these groups were determined before the tests in order to enable application of *recall* and *precision* measures (for a definition of these measures, see [Baeza-Yates 1999]). The groups covered the following topics: cards, people, planets, pyramids and rhinos.
The tests consisted of 25 queries to GIVBAC each. Every query used an example from the group chosen at random. The weights for the features were freely selected by the test persons, just as in a real scenario. User feedback was collected on each of these queries. The queries which generated the groups were used as references against which the changes in performance could be measured. Every fifth query was followed by a query using the reference image and parameters. The actual results at these points

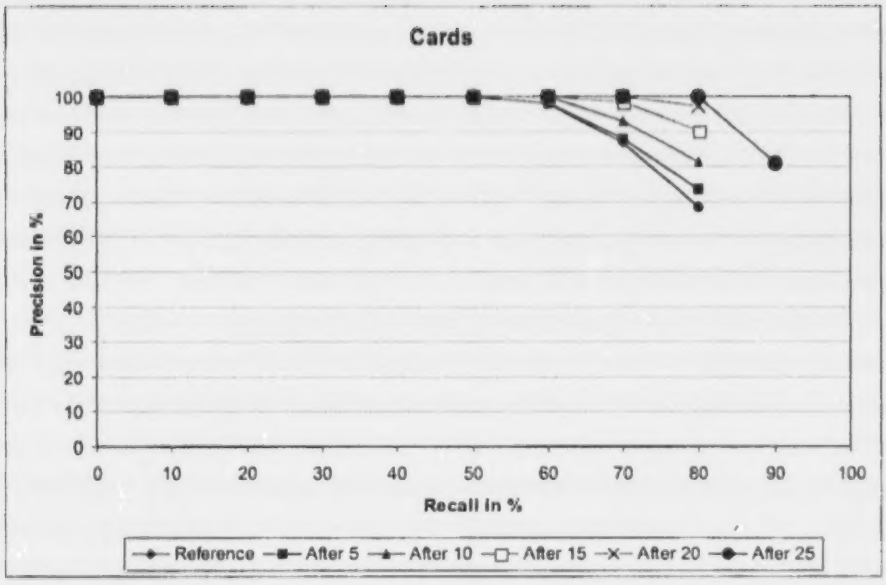

Figure 2: Evaluation results: Diagram for the group depicting cards

were then plotted in a recall-precision diagram alongside the reference query. The user group for the tests consisted of five users, so s was set to a relatively small value, namely 1.01. Larger values for this parameter would lead to the same conclusions but would need more iterations.

(Fig.2) shows the results for a group with rather homogenous contents: playing cards. Every image has the same structure and background, the only differences lie in the value of the cards. This group performs very well even in the reference system. GIVBAC is outperforming the reference after five iterations but the increases are mainly in precision and not that significant due to the high quality of the reference query. At the 25th query an increase in recall occurs, a welcome side effect of the voting process. In this context it has to be noted, that traditionally precision-recall diagrams use the full extent of the x-axis but since CBIR deals with thresholds, the full 100% of recall is almost never reached.

(Fig. 3) shows a group that shows the performance of GIVBAC in an environment that is especially bad for CBIR engines. The group in question has rhinos as a theme. The images hugely differ in composition, virtually the only common theme is indeed, that on the images somewhere a rhinoceros can be seen. Even some of the test persons could only solve their task through the list of relevant images. The diagram clearly shows the significant increases in precision as well as recall during the course of the experiment. These two diagrams represent the opposite sides of the spectrum encountered during the experiments. GIVBAC outperformed the reference query in every test, with varying levels of success. The greatest gain was achieved for the group depicting rhinos. The result set size for this group was reduced by 48% in the course of only 25 queries while simultaneously raising the maximum recall to 90%. This raise is achieved because images which were initially rated worse than the threshold have been promoted to a better ranking through positive user feedback. Even the group depicting cards (which has very good retrieval properties) has profited from the use of user feedback. The gain is lower – only 18% – but under the circumstances of this group this still means, that the first 80% of the relevant images for this group are shown, before the first mismatch is encountered. The same query for an unmodified system only manages this feat for the first 50% of the group.

The results of the performance tests show the feasibility of the approach. The improvement covers

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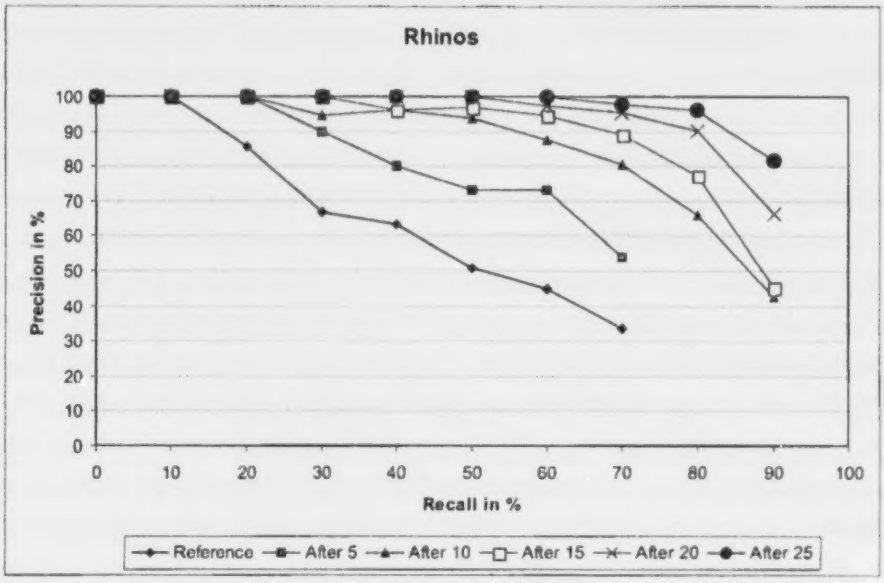

Figure 3: Evaluation results: Diagram for the group depicting rhinos

precision as well as recall, so that the result sets are at least as good as in an unmodified system. The tests also showed, that the approach works even under difficult suppositions, although this may necessitate a greater number of iterations until satisfactory results are reached.

1 Conclusion

This paper describes the outlines of an approach that aims at improving the performance of CBIR systems by using results from user feedback outside of the scope of the queries the feedback was given to. The approach presented is used as an interface to an already existing CBIR system and its database, but is independent of a specific CBIR system. That allows for easy adaptation to changes in the underlying system or an exchange for a new one.
The approach uses thematic groups that can be generated by the owners or users of the system. Feedback is given on the relevance of results according to one of these groups. An additional feature of the approach is its scalability with regard to the expected size of the user base.

Evaluation results are given and they show the possible gains if the approach is used. Both precision and recall can be improved, with the gains in precision being larger than for recall.

Further work will include inclusion of a client using this approach into a digital library developed at our department so that it may be used by a wider audience. This will allow collection of long-time data on the performance of and user feedback on the client itself.

While being most suited for the image parts of digital libraries in which some degree of control over the use of the system can be exerted, application of the approach is possible in search engines on the WWW, due to the scaling factor. Usage in such an environment would however necessitate additional work in the areas of right management (such as: Who is allowed to create new groups? Should feedback of named users count for more than that of anonymous users? etc), which is outside the scope of this work.

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Integrating Internet-based Mathematical Manipulatives Within a Learning Environment

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Abstract: The use of manipulatives within a mathematical classroom environment has traditionally been offered through the use of manufactured or teacher-created concrete objects. Manufactured manipulatives are ones such as cuisenaire rods, color tiles, colored craft sticks and pattern blocks. Teacher-created concrete objects consist of cardstock, foam or other paper templates. These are used to provide tactile-kinesthetic learning activities to enhance mathematics conceptualization. The Information Age offers mathematics educators the opportunity to integrate the use of digital manipulatives similar to manufactured and teacher-created ones using the World Wide Web as an innovative medium to expand the learner's conceptual framework of understanding. The availability of such Web-based mathematical manipulatives is an ever-expanding possibility that can be integrated into student-centered learning environments.

Introduction

The integration of manipulatives within the mathematical learning environment is not an original concept. Manipulatives have been integrated into the learning environment for numerous years. Pre-information age counting activities involved the use of fingers which maybe looked upon as one of the earliest manipulatives. The primary purpose of the manipulative was to offer a concrete visualization of mathematical concepts that lead towards an understanding of the mathematical concepts as defined by learning objectives.

> All students should be able to reason and communicate proficiently in mathematics. They should have knowledge of and skill in the use of the vocabulary, forms of representation, materials, tools, techniques, and intellectual methods of the discipline of mathematics, including the ability to define and solve problems with reason, insight, inventiveness, and technical proficiency. (Connected Mathematics Project, 2001, paragraph 2)

Within this framework of proficiency, manipulatives create familiar, concrete and understandable representations of information that are often "unfamiliar, abstract, and confusing to students" (Burns, 2001a, paragraph3). The appropriate integration of manipulatives within the learning environment ensures the learner's conceptualization of mathematical theories and tasks at a level appropriate to the learner by providing stimulating visual and concrete representations.

Manipulatives

Manipulatives have been integrated into learning opportunities for years. "One of the first advocates of 'hands-on learning' was the Swiss educator Johann Heinrich Pestalozzi (1746-1827). Pestalozzi asserted that students need to learn through their senses and through physical activity" (Resnick, Martin, Berg, Borovoy, Colella, Kramer and Silverman, 1998, paragraph5) and rebelliously struggling for "things before words, concrete before abstract"

(Pestalozzi, 1803). However, the introduction of manipulatives within a mathematical environment has exponentially expanded the conceptualization of the theories related to the task by the learner. Numerous positive attributes can be associated with manipulatives, as manipulatives can offer the following aids within the learning environment:

1. Manipulatives help make abstract ideas concrete.
2. Manipulatives lift math off textbook pages.
3. Manipulatives build students' confidence by giving them a way to test and confirm their reasoning.
4. Manipulatives are useful tools for solving problems.
5. Manipulatives make learning math interesting and enjoyable.
   (Burns, 2001a, paragraph 3)

However, the use of manipulatives within the learning environment comes with specific procedural tasks. Burns (2001b, paragraph 1) describes several specific "musts" that need to occur to facilitate positive correlations when manipulatives are used. Concurrently, our classroom experiences with manipulatives reinforce these "musts" as follows.

1. The instructor conducts on-going dialogue with students about why manipulatives help them learn math.
2. Ground rules are set and consistently communicated as students work with manipulatives.
3. Students are encouraged to develop a system for using and storing materials in the classroom under the teacher's direction. Materials managers are appointed to help with these tasks.
4. Time given to students for free exploration provides for more "on-time" behavioral applications as necessary.
5. Manipulatives are a natural for writing assignments, giving students' a writing focus. That is, to describe, to illustrate, to outline what happened, etc.
6. Parents are given opportunities to gain hands-on experiences using the manipulatives.

All the aspects discussed above refer to the concrete manipulatives that are available within learning environments. Mathematical manipulatives have been integrated into the learning environments to expand the learner's conceptual framework of understanding and to develop a link between theory and concrete explanations of mathematical concepts. But we are at the beginning of a new age, the Information Age that begins the shift from mere concrete manipulatives that can only aid the learner in conceptualizing the more simplistic mathematical theories towards digital manipulatives that offer the learner a conceptualization of more advanced, difficult mathematical theories in a digital arena. Digital manipulatives can be appropriately and successfully integrated into a mathematical learning environment through the use of World Wide Web-based materials. The use of digital manipulatives provides an interactive environment with immediate feedback to explore in-depth mathematical theories that would be difficult to simulate with concrete models. Additionally, younger students are able to "see" (conceptualize) concepts that would normally be regulated to in-depth abstract mathematical principles.

Manipulatives Available on the World Wide Web

World Wide Web-based manipulatives offer a creative, useful variety to the learning environment. These interactive materials enhance the knowledge and understanding of learners, while creating a conceptual understanding of mathematical theories beyond the mere formulaic models of traditional mathematical coursework. "These new manipulatives – with computational power embedded inside – are designed to expand the range of concepts that children can explore through direct manipulation, enabling children to learn concepts that were previously considered 'too advanced' for children" (Resnick et al, 1998, paragraph 4).

As examples of digital mathematical manipulatives available on the World Wide Web, GeoComputer (Riverdeep Interactive Learning Limited, 2001) offers the ability to create, flip, and rotate shapes to make colorful designs while simulating the concepts of reflections, translations and rotations. Students are also able to have interactive experiences with basic principles of geometry and measurements. Number sense concepts including fractional computations are enhanced by using pattern blocks and other virtual manipulatives embedded in Web-based applets developed specifically for use within a mathematical learning environment. The use of such manipulatives within a mathematically appropriate learning environment enhances the learner's conceptual understanding of material that would previously be considered too advanced or inappropriate.

Through the appropriate and successful integration of the mathematical manipulatives within a Web-enhanced learning environment, "children, by playing and building with these new manipulatives, can gain a deeper understanding of how dynamic systems behave" (Resnick et al, 1998, paragraph 12). Further,

> Such explorations would not be possible with traditional (non-computational) manipulative materials. Computation and communication capabilities play a critical role: they enable physical objects to move, sense and interact with one another – and, as a result, make systems -related concepts more salient to (and manipulable by) children. (Resnick et al, 1998, paragraph 12).

Numerous Web-based mathematical manipulatives are available for appropriate and successful integration within a mathematical learning environment. However, the engagement of the learner in innovative ways of thinking and learning about mathematical concepts is the focus of the exercise.

Conclusion

Web-based mathematical manipulatives are available for integration into the learning environment. However, thoughtful consideration must be given to the instructional design of the course and the specific learning objectives for each module of instruction. The focus of Web-based manipulatives is to enhance the learner's understanding of advanced theories and levels of understanding; "Our primary goal is not to help users accomplish some task faster or more effectively, but rather to engage them in new ways of thinking. In short, we are interested in Things That Think only if they also serve as Things To Think With" (Resnick et al, 1998, paragraph14). The Web-based manipulatives offer the computational abilities that aid in the communication of advanced concepts and theories to the learner. The focus is on the learner and the conceptual framework of understanding that is created due to the appropriate use of digital, Web-based mathematical manipulatives.

Conclusion

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Designing and Developing WebQuests for the Mathematical Learning Environments: Focusing Upon Higher Order Thinking Skills Within the Learner-Centered Learning Environments

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Abstract: Mathematical learning environments emphasize the importance of higher order thinking skills within the learning environment. One aspect that offers the integration of mathematical subject matter, higher order thinking skills and a learner-centered emphasis of instruction is the design and development of WebQuests for the mathematical classroom environment.

Introduction

Mathematics is a subject matter that has been traditionally taught as a drill-and-practice in a formulaic environment that emphasized a "correct" or "incorrect" response by the learner. Yet times have shifted towards a more constructivist learner-centered and group work emphasis. After all, "Effective teachers intuitively know that student attitudes and academic achievement are improved when learning experiences revolve around the interests, talents, and needs of students" (Texas Metronet Incorporated, 2001, paragraph 1). With the rise of the World Wide Web and the availability of a bounty of useful Web sites, the integration of the Web within the mathematical learning environment has found that its time has come.

Bloom's Taxonomy of the Cognitive Domain and Higher Order Thinking Skills

Higher order thinking skills provide opportunities to further examine and broaden the focus upon Bloom's Taxonomy. Thomas, Thorne and Small (2001) offer a brief description of what higher order thinking skills emphasize.

> Higher Order Thinking, or HOT for short, takes thinking to higher levels than just restating the facts. HOT requires that we do something with the facts. We must understand them, connect them to each other, categorize them, manipulate them, put them together in new or novel ways, and apply them as we seek new solutions to new problems. (Thomas, Thorne & Small, 2001, paragraph 7)

Basically, higher order thinking skills (HOTS) can be broken into three categories: content thinking; critical thinking; and, creative thinking. Each aspect of HOTS emphasizes a different level within Bloom's Taxonomy. The complex levels of thinking processes associated with HOTS parallels the synthesis and evaluation levels of Bloom's Taxonomy. As patterns of higher order thinking are emphasized in learners within all levels of the educational system, each subject area emphasizes the creation of innovative aspects that aid the learner towards the creation and reconceptualization of thought patterns; in other words, viewing the information from numerous perspectives and within real-world environments. The introduction of the World Wide Web into the mathematical learning environment will emphasize the synthesis and evaluation levels of Bloom's Taxonomy while also focusing efforts upon higher order thinking skills.

Learning Activities for the World Wide Web

The World Wide Web (Web) is an enormous storehouse of information that is freely available to anyone in the world. However, so much information can cause confusion and despair on the part of both the professional educator and the learner. Therefore, careful consideration must be given to appropriate learning activities that integrate and emphasize the strengths of the Web. The task of the educator is to design and develop appropriate learning environments for the learner, whether this is in an instructor-centered or a learner-centered manner. Over the previous ten years a growing interest in constructivism, and an appropriate inquiry-oriented, problem-solving learner-centered learning environment has matured. The focus upon the learner's needs and the opportunity for the professional educator to take on the role of the facilitator, also annoyingly referred to the "guide on the side" rather than the all-knowing "sage on the stage". As group work has also developed a following, these aspects were melded into an innovative formula referred to by Dodge (1998, 2001a, 2001b) as a WebQuest.

WebQuest

One Web-based design that offers higher order thinking skills is the WebQuest. A WebQuest can be integrated within numerous subject matter areas; however, mathematical learning environments offer special emphases towards the use of the World Wide Web in a real-world problem-solving situation. The emphasis is placed upon creating a mathematically appropriate focus for an environment that develops an active, creative problem-solving community. Dodge's definition of "A WebQuest is an inquiry-oriented activity in which some or all of the information that learners interact with comes from resources on the Internet, optionally supplemented with videoconferencing" (Dodge, 2001a). Designing and developing a successful WebQuest must integrate the following elements within the WebQuest environment: An Engaging Opening; The Question / Task; Background for Everyone; Roles / Expertise; Use of the Web; Transformative Thinking; Real World Feedback; and, Conclusion (Dodge, 2001b, paragraph 1).

Through the careful review of WebQuests available on the Web and a creativity that is found in all mathematical subject matter experts, numerous interesting, subject-specific, inquiry-oriented group products can be created and integrated into a mathematical learning environment for learners to emphasize the real-world application of mathematical concepts and theories. Further, uploading the WebQuests to a Web server will allow other educators around the world the opportunities to integrate these WebQuests into their own appropriate learning environment, through which other learning environments can ensure that active learning occurs.

Conclusion

Mathematical learning environments naturally, due to the nature of the subject matter, focus upon higher order thinking skills. However, the introduction of WebQuests within the mathematical learning environment offers problem-based, real world applications with a learner-centered focus. The information available on the World Wide Web further defines and develops the perfect match of real-world information and subject matter expertise. The movement towards a realization of the strength when pairing two such powerful areas, the mathematics subject area and the World Wide Web, can only lead towards an innovative learning environment that emphasizes the learner's complex thinking processes and metacognitive processes.

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The Network for English Acquisition and Reading Star Schools Program (NEARStar): Teaching Elementary Students to Read English via the Web

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NEARStar is a 5-year grant from the U.S. Department of Education's Office of Educational Research and Improvement to Pacific Resources for Education and Learning (PREL), a non-profit educational training, research, development and technical assistance organization in Honolulu, Hawaii. The purpose of this grant is to develop research-based student instruction to teach beginning English reading and language to early elementary non-English speaking students, gather progress data through embedded assessments, and provide professional development to teachers, all delivered over the World Wide Web. Students learn to read English while engaging in interactive, game-like environments filled with animations, music, songs, and stories. Their teachers are a mouse-click away from just-in-time professional development resources that help them continue to build students' English skills.

WebEx: Learning from Examples in a Programming Course

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Abstract: Experienced and novice programmers often use program examples they have created or learned in the past to solve new programming tasks. Experienced teachers of programming-related courses know and use the power of example in their teaching. This paper presents WebEx - a Web-based tool for exploring programming examples that enables teachers to use example-based programming approach with heterogeneous classes. WebEx maximizes learning opportunity for every student, gives every student a second chance in understanding key programming examples, and encourages every student to explore example programs.

Introduction

It has often been claimed that humans use solutions to previous problems to solve new problems or planning tasks. Especially in the domain of programming, both experienced and novice programmers often use program examples they have created or learned in the past to solve new programming tasks. Experienced teachers of programming-related courses know and use the power of example in their teaching. The traditional approach to using examples in programming courses is the following. For each lecture the teacher prepare some number of carefully chosen problem-solving examples in the form of small programs. The teacher during the lecture analyzes these examples. To let the students further explore the examples and use them for solving assigned problems, the teacher provides the code of all analyzed examples as a part of printed or online lecture notes. Authors of good programming textbooks (who are good teachers themselves) also follow this approach and provide a lot of explained program examples in their books. To encourage the students to run and explore the provided examples many authors nowadays choose to place the code of all examples either on a CD supplied with the book, or on the book's Web site.

The problem with the traditional approach to using programming examples in the classroom is that it works well only for small homogeneous groups of students. Students in a homogeneous group have about the same level of programming knowledge and the same speed of material acquisition. Working with a small homogeneous group a teacher can usually predict the number and the complexity of examples for each lecture and choose the proper pace and level of detail for the presentation. In large heterogeneous classes where students have very different starting level of knowledge of the subject and acquisition capabilities the effectiveness of the traditional example-based approach decreases dramatically. Different students need essentially different speed and level of details in example explanations. Moreover, weaker students usually need more examples to understand the same concept. A teacher facing a heterogeneous classroom is destined to "lose" both strongest and weakest parts of the class during the lecture. Unfortunately for the students who have failed to understand examples presented in the class, there is no easy second chance. Even in a situation when the code of all examples is available online, it has little use for these students because the code itself lacks the explanation part.

We have designed WebEx, a Web-based tool for exploring programming examples to enable teachers to use example-based programming approach with heterogeneous classes. Our goal was to maximize learning opportunity for every student, to give every student a second chance in understanding key programming examples, to encourage every student to explore example programs and re-use it for problem solving. The core of WebEx is a database of explained programming examples prepared by teachers in a special "dissection" format. The environment lets each student to explore program examples in his or her own pace and order. In particular, weaker students will be able to work with more examples and explore each example in more detail. Currently we are using WebEx in the context of a course on Data Structures and Programming Principles at the University of Pittsburgh. However, WebEx is language and course-independent and can be used with any programming-related course. This paper presents the first version of

WebEx, compares it with earlier approaches to use technology in the context of example-based teaching of programming courses, and summarizes its benefits.

A Web-based environment to support learning from examples

The idea and the tool

The key innovative idea of the suggested project is to replace bare code of programming examples offered on the course Web site with *self-explaining examples*. To provide self-explaining examples we intend to use a popular approach to example explanations used in a number of programming textbooks and sometimes referred as "dissections" (Kelley & Pohl, 1995). With this approach, an author of an example (a teacher) supplies textual explanations for each line in the example program. The explanations serve at least two different purposes. First, it explains the student the meaning of each program line and its role of in the overall solution of a programming problem. Second, it comments on a particular way of using language constructs in every line of code thus bridging the gap between student general knowledge about programming language constructs and practical skills of their use for solving programming problems.

Figure 1. The code of a programming example is left intact in WebEx.
Green and white buttons to the left indicates availability of a comment for the given line.

In a typical programming textbook a dissected example is provided in a special format where each line of code is followed by explanations that can vary from a line or two to several paragraphs of text. This format has a clear problem: even in textbooks that use a special font and color for the lines of code, the code is hard to comprehend since the lines of code are spread among the explanations. The explanations are not easy to comprehend either.

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Usually, a student has a problem with just a few lines of code in a program and need explanations for just these lines. Presenting all explanations at once distracts the student from concentrating on most needed explanations. Finally, reading through a large "dissection" is a rather passive kind of learning.

WebEx, a Web-based tool for interactive exploration of programming examples, was designed to overcome the problems listed above. Our key idea is to leave the example code intact as much as possible (Figure 1). The program example looks in WebEx just the same way it looks in a program editor. The only visible difference is a presence of green or white bullets to the left of each line. Green bullet indicates an availability of explanations for this line of code. While bullet tells that there are no explanations for the line. Naturally, clicking on a green bullet opens an explanations note for the selected line (Figure 2). In a spirit if a good hypertext, this interface let the user to use his or her preferred browsing strategy. Some users may want browse the example line by line. Other students may concentrate on the most hard-to-understand lines and selectively read explanations for these lines. In the example on Figure 3 the role of the line being explored is not obvious even for good students who may have no troubles with understanding all other lines. When exploring this example such students can go straight to this troublesome line ignoring other unnecessary explanations.

Figure 2: In WebEx example explanations are shown one at a time next to the line being explained (the bullet and the font for this line is changed to provide the context)

WebEx approach offers several benefits over the traditional book format. First, the code of the example is shown as an easy-to-grasp single chunk, instead of being distributed among the comments. Second, explanations are shown one by one helping the student to concentrate on one thing. Third, from being a passive reading activity the work with every example become an interactive exploration. As an extra benefit, every action of the student in this environment can be recorded thus providing a teacher with a possibility to monitor the student activity and giving an educational researcher a powerful tool to explore how student work with examples in a programming course.

While the first version of WebEx is already in use by students, we need some time to evaluate the effectiveness of WebEx as a teaching and learning tool. It is out hope that a database of interactive explained examples will give every

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student a second chance to understand key programming examples. Each student will be able to work with the examples in his or her own pace requesting only necessary explanations.

Figure 3: With WebEx a student can selectively choose explanations of the most hard to understand lines of code that are usually different for different students

Implementation

The database of examples is implemented using Microsoft Access. The interactive part of the environment (examp le exploration and navigation between examples and concepts) is implemented using Microsoft Internet Server and Active Server Pages technology. The choice of Microsoft tools is determined by their free availability for faculty and students or our university. Besides, Microsoft Access system is relatively easy to use and has a simple interface. We have found that teachers and teaching assistants have no problems with copying, commenting, and contributing their examples in Access tables. Currently, we use WebEx in the context of a Blackboard CourseInfo (Blackboard, 1999) course management system (CMS), however, it is independent from CourseInfo and can be used as a standalone application or in conjunction with any CMS.

Related works

While the idea of interactive self-explaining examples on the Web is innovative, the idea of a shared database of examples is not entirely new. We know (and will use an experience of) several example-based programming environments that let the students use a database of examples in the process of problem solving (Brusilovsky & Weber, 1996; Brusilovsky, 1992; Burow & Weber, 1996; Faries & Reiser, 1988; Guzdial, 1995; Hohmann, Guzdial & Soloway, 1992; Linn, 1992a; Linn, 1992b; Redmiles, 1993). With two exclusions, the only function of example-based programming systems was to help the student find a relevant example. In most of the cases the systems simply let the student pick a static program example from a large list or search for an example using keywords. Two systems went further and provided some interface to the student to explore an example. In a system designed by Redmiles (1993) explanations for an example were "hardwired" into the system's code by the author himself. ELM-PE (Burow &

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Weber, 1996) applied an Artificial Intelligence approach. Using its knowledge about programming goals and an ability to "understand" the program, it can interactively generate a goal-based explanation of every function of any program example represented in the system. Our approach is integration of these two. WebEx can provide an explanation for every line of a program in any language with a very little authoring overhead. WebEx is a practical tool that can be used in any programming course. Still, like the tools mentioned above it has an important research agenda - to explore how the students ue examples in programming courses.

Current development

Student side

The experience of the previous works on databases of examples lets us anticipate a problem of navigation. As we noted, known databases typically let the student pick an example from a large list or search for an example using keywords. However, an experiment with ELM-PE environment (Weber, 1996) shows that only in two thirds of all cases were the users able to find the most relevant example using these simple example-selection tools. For our case the navigation problem may be even more serious since the estimated number of examples in our environment will be several time larger than in the known databases.

To help the students navigate in our database of examples we plan to organize all examples into a hyperspace. This idea was originally explored by Linn (1992b) who also has shown that this hyperspace has to be structured following expert-level understanding of the subject. We intend to apply a concept-based approach to structure the hyperspace of examples. The concept-based approach was originally suggested by the author to structure the hyperspace of pages in the InterBook system (Brusilovsky, Eklund & Schwarz, 1998). The core of the concept-based navigation is a glossary of concepts used in the course - from C programming constructs (assignment operator) to higher level concepts (loop). The users are able to observe a description of each concept in on a separate glossary page. The system maintains two-way links between an example and each concept used in this example. That means that from each concept page students are able to move to all examples that demonstrate the use of this concept. Vice versa, from each example page the student will be able to move to description of each involved concept. This approach supports rich navigation. In particular, starting from an example of interest, the student will be able to move to an explanation of a troublesome concept used in this example and from that to another simpler example that uses this concept. Our experience with InterBook shows that this organization can successfully support navigation in a hyperspace with several hundred of content pages (i.e., examples) and more than a hundred of concepts. In addition to the new concept-based access to examples we intend to keep currently implemented syllabus-based access where the student can get a list of links to all examples relevant to a given lecture.

Teacher side

One of the key assumption behind WebEx is that examples in a database are contributed by several instructors who teach different sections of the same course. Thus, from being a secondary support for teaching a particular section of the course, the database of examples will become a shared resource for the whole course, a place to accumulate the "instructional wisdom" of several teachers. Once initiated, this database can be used by several generations of instructors who can also contribute their favorite examples. As it often happens are taught by different instructors in different years. In this situation the shared database of examples will offer a significant reduction of work for a new instructor of the course. Instead of preparing and testing a large amount of examples to analyze at every lecture, a teacher can simply pick and re-use a subset of examples from the database that he or she founds most relevant. The students themselves may have an access to the whole wealth of explained examples that will allow weaker students to work with more examples than were presented in the classroom.

We are now working currently on improving teacher's side of WebEx. In the original version of WebEx the teachers have to create and annotate examples using Microsoft Access directly. This approach worked well for one or two teachers. To support a larger community of teachers working on the same course we are developing a Web-based interface for teachers to create, update, and re-use examples. The goal is to make the system a tool in teacher's hands; to support all major activities of a teacher working with examples. Our experience shows that it is one of the main keys to the success of any educational system in the classroom.

Summary

Instead of providing a summary of the paper we have chosen to provide a summary of WebEx benefits.

- WebEx maximizes an educational opportunity for each student in an example-based programming course by providing a possibility to explore and reuse self-explaining programming examples. It provides a "second chance" for the students who miss the lecture or students who do not understand it completely. It also provides support for possible distance students.

- The teacher is able to spend less time on a routine analysis of examples during the lecture and devote more time to interactive and creative work with students. There is no need to ensure that most of the students "got" the examples since all of them will have a second chance. We expect some release of instructor's time that is currently spent on example analysis during recitations and office hours.

- The database of examples will serve as a "community" resource for all instructors of the target course. The amount of time required for a faculty to prepare a quality lecture for this course is significantly reduced.

- The database of examples developed and structured by experienced teacher can help less experienced instructors to teach the course better

- Due to the problem-independent nature of the tool, the WebEx can be applied in the context of teaching different programming related courses.

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Distance Learning Using a WWW Lesson Composer, Presenter, & Organizer*

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Abstract for Short Paper

*An approach for a software tool, the Science and Technology Literacy Desktop (**STLD**), that can organize disparate online educational content into coherent lesson plans, automatically generate links to related reference material, and provide assessment of student comprehension is presented. Based on an enhanced web browser concept, it allows access to a wide variety of material and formats, yet provides the controls necessary for an instructor to administer effective lessons. This software takes a significant step beyond current educational software offerings that lack extensibility to a range of information as broad as that found on the Internet.*

Short Paper

(max 1875 words)

Introduction

The introduction of the internet has brought a whole new perspective in how to provide learners with educational materials. Of greatest potential is the use of materials already resident on the WWW. A student can go to a number of WWW sites and access an abundance of material on many topics. With many institutions such as zoos, museums, and libraries hosting WWW portals into their treasured contents, taking students on virtual tours can be accomplished from a simple desktop computer equipped with a standard WWW browser.

Unfortunately, allowing the student to "surf the Web" will not work as a lesson. The student will encounter a vast array of uncontrolled information. Currently instructors do not have the tools to identify, filter, and index the desirable materials. Nor are there tools to support the student's endeavors in understanding the material. There is too much information available and instead of being a time-saving device for producing quality lessons, the WWW ends up being another sink-hole of instructor time. Thus, we have concentrated on providing a tool, called (for historical reasons) the Science Technology Literacy Desktop (***STLD***), to aid instructors in identifying, filtering and organizing information as well as support the student in understanding the presented material.

The ***STLD*** appears as a Web browser, providing a familiar interface along with additional functionality brought together to provide an enhanced learning environment. By virtue of being a Web-based tool, it allows instructors to incorporate their own material, as well as incorporating existing Web-based material into a lesson. Projects can now be designed to allow the student to browse on-line through lesson material that is resident on the WWW. Instead of developing material from scratch, the instructor can organize a lesson that is composed of "pointers" to already existing WWW material along with auxiliary instructions and background information. Activities and check-point quizzes can also be integrated. A complete lesson can be composed and stored within the ***STLD***, and then later browsed by a group of instructor-identified students. As students interact with a lesson, the ***STLD*** tracks their activity, providing the instructor with student status and progression.

In order to support the student's learning of the lesson material, the ***STLD*** also provides the capability to have the student "click" on a word or term and have options presented to them for performing further research (e.g., from a simple dictionary

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look-up, to accessing an encyclopedia, or even another WWW site dedicated to that topic). This capability is supported by having the instructor identify on-line reference materials, CD-ROM materials, WWW sites, and other on-line sources (e.g., picture databases) that contain information pertinent to the curriculum they are teaching. These references are contained within the indexing scheme of the ***STLD***, and are automatically hyper-linked (with no instructor burden) into the lesson document being browsed. For example, a student reading an article on giraffes may encounter the word 'herbivore' and wish to know its definition or antonym, see pictures of various herbivores, or be interested in seeing exotic herbivores found in mythology. The student only needs to select the word and then identify the type of information desired.

It is the instructor who selects the education material so as to tune the lesson to the student, constantly challenge the student's skill level, and maintain their interest. The tools that the instructor uses must allow for the flexibility of selectable material

Unfortunately, pulling such pieces together into an actual lesson is very challenging and time consuming for the teacher due to the up-to-the-minute aspect of the information. The pieces can be from varied sources, in varied formats, and not at all close to a presentable state in terms of a classroom lesson. This is where our approach differs from other pedagogical tools. We are concentrating on methods of presentation and comprehension that would allow the addition of new on-line material (especially Internet) by the instructor with minor effort. Thus, the lesson can be tuned to the students and to current events, constantly challenging their skill-level and maintaining their interest, while reducing human instructor load.

Approach

Our approach is to quickly develop a series of ***STLD*** prototypes, incorporating latest advances in technology, and testing new concepts for viability. This allows a quick determination of which technologies are feasible in the short-term and which are not yet mature for insertion, but deem to require monitoring of new advances. We have been investigating technologies from Java-based browser development, speech understanding, pattern recognition and manipulation, ontologies, readability, machine understanding of text and concepts, and artificial intelligence-based text generation. We are not attempting to replace or duplicate existing web browser products, only to provide tools that will aid in organizing and presenting on-line material into a defined lesson after it has already been discovered. This also includes a tool for retaining

develop extensions that can be added to current versions of such applications, and that focus on aids for science and technology literacy. We believe that many of the capabilities being developed by this effort are also applicable to general literacy and education.

Usage of the *STLD*

The envisioned usage of the tool is that of the instructor identifying on-line reference materials, CD-ROM based materials, Internet sites, and other on-line information sources (e.g., picture databases) that contain information pertinent to the curriculum they are teaching. The instructor interacts with the "Lesson Generator" and the "Add-Reference Wizard" components of the ***STLD*** in identifying these sources. Using these components, the teacher is walked through a series of simplified questions and options pertaining to the Internet pages that compose the lesson, instructions associated with the lesson and with each page, identified resources and reference; and activities or quiz questions automatically generated in association with each web page. At this point the lesson is defined and registered into the teacher's lessons area. Students can access the lessons through the ***STLD*** Internet browser. The resources/references identified by the teacher are contained within the indexing scheme of the ***STLD***. Whenever a student desires additional definition or background on a specific topic or word, such information from the identified references has already been automatically hyper-linked into the document being browsed and thus the student can access the information with a mouse-click and a menu selection. For example, a student reading an article on giraffes may encounter the word 'herbivore' and wish to know its definition, antonym, or examples of other herbivores. Other example uses include loading up a picture of a giraffe from a picture database, or searching a mythology encyclopedia for myths about giraffes. Such information would be found in the on-line dictionaries, encyclopedias, and other references in abundance across the WWW and identified by the teacher during the lesson generation. The student only needs to select the word and then identify the type of information desired. The automatic hyper-link generation has already cross-referenced the word with the reference material, and the desired information can be accessed across the web and displayed for the student. The benefit is that auxiliary web-based reference information is easily accessed,

and thus utilized, enhancing the learning experience. The wealth of the WWW can be quickly organized into a focused lesson with linkage out into more WWW wealth. This approach can also work for general browsing where there is no defined lesson plan. Instead, references have been identified and thus can be quickly hyper-linked into a web document as it is loaded into the browser.

The ***STLD*** can be used by students – either with or without instructor customization – to browse the Internet by downloading any document and having the full science and technology literacy reference aids available to them. The hyper-linking does not alter the original document, nor interfere with any other hypertext already residing in the document. Essentially, this browser functions as any other Internet browser, yet with added functionality to support science and technology literacy.

When multiple references are identified, they are listed as possible options for selection based on what type of reference source each is (dictionary, encyclopedia, thesaurus, or specific Web pages on the selected term/concept). The options may be filtered or ordered based on the age appropriateness and the reading level of the student. The student's reading level can be estimated through initial solicitation of age/grade from the student augmented by the use of intelligent tutoring techniques that observe the student's usage of the tool, and based on their actions and the documents they are reading, infer their current reading level. Similar readability metrics can be applied to the reference material to provide a gross-level matching. Essentially, we desire to avoid mismatches such as a second grader using a college level dictionary or a college level reader using a children's picture dictionary. As the student progresses, records of their estimated reading level can be kept along with information on topic interests. This information can be used to provide suggested documents for the student to read based on age, reading level, and interest.

As each new Internet document is downloaded, readability metrics similar to those used to assess the student's level, can be calculated and provide reading difficulty statistics on the document and anticipate the fit of the document to the student. From this the ***STLD*** can provide guidance to the student towards a better fit to their abilities, and thus reduce the frustrations associated with searching and filtering for articles that match the student.

Finally, the student would have the option to generate and participate in activities or to take a quiz upon the material. Both activities and quizzes would be automatically generated from the browsed document's content, presented to the teacher for review (during lesson generation) and then during the lesson given to the student for on-line interactions. Since the activities (i.e, word bingo, crossword puzzles, etc.) and quiz questions are generated from the browsed material, it provides a vehicle for the student to self-check comprehension. The automatic generation is based on the artificial intelligence techniques in lexical databases, large-knowledge-base designs, and pattern matching and manipulation.

Conclusions

We presented the concept of the ***Science and Technology Literacy Desktop*** that provides both student and teacher with the capabilities to find, organize, and understand science and technology related material on the WWW. This ongoing research and development effort is attempting to apply new technology to the problem of science and technology literacy in our classrooms. The results of this effort should be applicable beyond science and technology literacy, finding use within other focus areas of education and training, as well as general literacy, English as a second language (ESL), and even as a general WWW browsing aid.

Ask Smartypants! A Web-Based Tool to Help Busy Educators Keep Up With Research About New and Emerging Technologies

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Abstract: The Institute for the Advancement of Emerging Technologies in Education (IAETE) and Knowledge Management Software, Inc. have partnered to create a Web-based solution that provides access to summaries and syntheses of literature related to new and emerging technologies. Panels of experts drawn from various industries are identifying resources that provide valuable information about potentially useful emerging technologies. Content experts will summarize articles from a variety of sources. Education experts will meet quarterly to glean the implications for education from the summaries, develop applications for consideration, and identify possible challenges. Results will be posted to the *Ask Smartypants!* Web site where educators may search the database of summaries through a simple interface using natural language queries. Users will receive syntheses of possibly relevant research and will rate the usefulness of the returned syntheses. The software will "learn" which reviews best answer particular questions. Subsequent searches will be modified to reflect these evaluations.

In this day of information overload, how can professionals keep abreast of useful information about new and emerging technologies? Amid literally thousands of journals and trade magazines, articles are published at astounding rates. It would be difficult for a single professional to skim every publication and nearly impossible to read every article. This is not a problem exclusive to education. Similarly, busy physicians likely do not have time to read every medical research journal, but it is important for them to be aware of best practices and promising treatments. The Evidence-Based Medicine model was developed by The Centre for Evidence-Based Medicine (Oxford) and helps busy doctors make use of medical research in their daily practice by providing two resources: *Best Evidence CD-ROM* and the *EBM Journal*. The CD-ROM reviews research on relevant conditions, symptoms, treatments, and diagnostic tests. The journal presents abstracts collected from approximately 70 journals that were screened by a panel of expert clinicians and deemed valid, as well as clinically important. The journal drastically reduces the amount of reading time needed to cull the significant studies from hundreds of journals (Willinsky, 2000).

Like the physicians mentioned above, busy educators struggle to find time to read research and informative articles on promising technology practices and potentially valuable emerging technologies. To make things more difficult, information about new and emerging technologies is not always found in education journals, because cutting-edge devices and practices are often developed with other industries in mind and appear in popular media first. Thus, even after reading about potentially significant ideas in education or other industries, educators and administrators are often left without a clear understanding of how they can adapt such ideas for use in classrooms, schools, and districts.

The Institute for the Advancement of Emerging Technologies in Education (IAETE) and Knowledge Management Software, Inc. have partnered to create a tool that will assist practitioners in finding research and other information relevant to their needs. Modeled after the Evidence-Based Medicine paradigm, *Ask Smartypants!* is designed to assist practitioners in the identification, evaluation, interpretation, and application of the most relevant research related to new and emerging technologies.

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More than 1,000 journal titles have been collected to represent ten content areas: Aeronautics & Space Science, Biological Sciences, Business, Computer Science & Automation, Education, Engineering & Technology, Medicine & Health, Military, Physics, and World Wide Web & Internet. The titles were identified using recommendation lists from prominent associations and organizations, in addition to *Magazines for Libraries* (Katz & Katz, 2000), a publication used by academic and public libraries in collection development.

Using a modified Delphi technique, IAETE is assembling the publications that provide reliable, valid, and useful research, as well as valuable information from trade journals and popular titles about potentially useful emerging technologies. The modified Delphi group is comprised of panels of experts representing each of the ten content areas. Each member of every panel is asked to identify from the list of journals those that provide useful information about new and emerging technologies relative to his identified content group. The questionnaire requires members to indicate recommended retentions and deletions from the original list of journal titles. Additionally, the members are asked to suggest additional titles that should be included.

After the questionnaires are returned to IAETE, they will be analyzed, and titles will be divided into categories: 100% consensus, 75-99% consensus, 50-74% consensus, and under 50% consensus. A second questionnaire will be dispatched to the panels, including the titles receiving 50-100% consensus and recommended additions. The process will be repeated. Once consensus is reached on the resource list, IAETE staff will begin to arrange for subscriptions to the selected titles and a Tier-1 Review Group will be identified.

The number of journals selected during this modified Delphi process will determine the number of members in the Tier-1 Review Group. (For example, there may be 15 members representing Education and only 5 members representing Aeronautics & Space Science.) Each member of the Tier-1 Review Group will be responsible for monitoring assigned titles, selecting useful articles from the publications, and composing summaries based on a template provided by IAETE. Guidelines for selection and composition are under development by IAETE and will be distributed to Tier-1 group members.

Once the Tier-1 Review Group has been launched, a Tier-2 Review Group will be assembled. The members of the Tier-2 Review Group will be experts in education who have hands-on school and/or classroom experience and are thereby able to glean the implications for education from the summaries completed by the Tier-1 Review Group and evaluate its potential for impact. The Tier-2 Review Group will meet quarterly to develop school and/or classroom applications for consideration and to identify possible challenges that may arise as a result of implementing the applications.

Following the Tier-2 Review Group's quarterly meeting, the knowledgebase will be populated and the Web site (www.asksmartypants.org) will be fully operational. Educators will be able to type a natural language question on the Web site to receive a list of possibly relevant research reviews. The user will be asked to evaluate the usefulness of the returned reviews. Through the user's response, the software "learns" which reviews best answer each question. Using confidence ratings, future output is modified to reflect user satisfaction on previous searches.

Furthermore, questions that are not answered to the user's satisfaction are forwarded via email to the site administrator, resulting in a list of questions that are not being answered by current research. As a result, IAETE plans to draw on users' unanswered questions to shape future research agendas. As gaps are identified, research can be planned to address that need. In essence, practitioners will begin to influence the research conducted by IAETE, as well as the entire R&D community.

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Creating Virtual Labs to Teach Middle School Astronomy Principles: The NASA Connect Education Program Series

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Abstract: This paper will present a case study analyzing the design process and interactive web product developed by instructional technology graduate students at Virginai Tech to support the NASA CONNECT distance education program. The NASA CONNECT program will be described and the various ways to interact with this dynamic program will also be enumerated. NASA CONNECT is an award winning distance education program that incorporates multiple modes of delivery and student engagement and is managed out of the NASA Langley Research Center, located in Hampton, Virginia. Serving thousands of students each year, NASA CONNECT is but one of a myriad of educational programs sponsored by NASA. But some might question "Why NASA is involved with education at all?"

Why is NASA Interested in Education?

The National Aeronautics and Space Administration has as one of its cross cutting strategic enterprise goals the charge of sharing NASA's content knowledge with k-12 education and enlightening inquisitive minds through supporting the nations education goals and standards in science, mathematics, technology and geography. NASA's top administrator, Dan Goldin, in his April 1999 address to the United States Congress, House of Representatives Committee on Science stated:

> Education is the single most important issue our generation faces today that will influence our Nation's course for the future...NASA's success depends on the educational system to produce the highly skilled and knowledgeable workforce that is necessary to perform this cutting edge work. Likewise, the Nation's educational system looks to NASA for inspiration and to exemplify doing things that once were only imaginable -- feats that motivate and encourage our students to study science, mathematics, technology, and engineering. Future leaders of America, even if not astronauts, scientists, or engineers, must have a fundamental understanding of science, mathematics, and technology to reap the rewards of NASA's discoveries.

NASA CONNECT Program Overview

As stated previously, The NASA Langley Research Center produces the NASA CONNECT program, which is targeted toward middle schools students in grades 5-8. The overarching goal of NASA CONNECT is to establish the "connection" between the mathematics, science, and technology concepts taught in the classroom and NASA research as tied to appropriate national standards. NASA CONNECT capitalizes on multiple modes of dissemination (web, print, and video) and utilizes several methods of student engagement (interactive virtual labs, hands-on classroom inquiries, critical student discourse using complimentary video questionnaire guides). A series of live video broadcasts provide the foundation for the NASA CONNECT program and are broadcast nationally over NASA TV, Satellite and PSB TV stations. An in-depth teacher guide is also available to download after registering to participate in the free NASA CONNECT learning program. Samples of the titles for the 2000-2001 season include: (a) MEASUREMENT, RATIOS, AND GRAPHING: 3, 2, 1...Crash; (b) GEOMETRY AND ALGEBRA: Glow with the Flow; (c) DATA ANALYSIS AND MEASUREMENT: Ahead, Above the Clouds; and (d) FUNCTIONS AND STATISTICS: International Space Station (ISS)-Up to Us.

NASA CONNECT: Asynchronous Interaction

The video component of NASA CONNECT may also be viewed asynchronously by dubbing the copyright free content during a live broadcast or by ordering a high fidelity copy from NASA CORE (Central Operations of Resources for Educators) for a nominal fee.

CORE is a worldwide distribution center for NASA-produced multimedia materials and can be found on the web at: http://www.core.nasa.gov. Interested parties may request via phone, fax or print mail other multimedia productions in addition to previous NASA CONNECT videos. The NASA CONNECT video series may also be dubbed free of charge by bringing a blank VHS tape to the nearest NASA Educator Resource Center (ERC) in your state. To locate the nearest ERC available to you visit the ERC Network on the web at: http://spacelink.nasa.gov/ercn/.

The interactive web-based virtual labs, hands-on classroom inquiries and student video questionnaires from previous and future NASA CONNECT topics are available on the web at the NASA Langley Research Center and may be located at: http://connect.larc.nasa.gov/. To locate current and future topics click the "2000-2001 Season" link found at the URL above. Previous components of prior shows may be found by clicking on the "Educators" link on the home page and then the link titled "Library of Shows" that appears atop the new page that loads for educators.

Our "Virtual Lab" Web Component

Our design project developed an interactive prototype web-based instructional unit to support the video program titled: *Algebra: Mirror, Mirror on the Universe*, which originally aired in April of 2000. In this multi-modal program students were encouraged to discover how algebra and telescopes are used in space exploration and why optics (the study of light) is important in astronomy. Students are guided to discern for themselves through the virtual web lab component the value of placing orbital observatories in space. Students move from backyard astronomy to mountain observatories and the Hubble Space Telescope to discern what we can learn about the origin of our universe and galaxies. Ultimately, a discussion of the Next Generation Space Telescope is presented. Topics like the electromagnetic spectrum, red shift, right ascension, and declination are discussed in detail with vivid multimedia animation and strong user control, feedback and interactivity.

A Look Back: Designing the "Virtual Lab"

We first met with the NASA CONNECT team members to discuss possible directions for our instructional program. The folks at NASA did not have a concrete vision as to what they wanted for the instructional program. They provided us with a list of science and math standards for students in grades 6 through 8 that they were interested in addressing, as well as an extensive list of information about telescopes. From that list we chose as many key concepts as we thought would be appropriate for the length of the instructional program, the development time, and

the age group involved. With this information at hand, we set out to develop an interactive program that would help students learn about telescopes and celestial observation while at the same time covering certain required science and mathematics standards.

We started by creating a context in which students would help NASA scientists search back in time for the origins of the universe. Astronomers are constantly attempting to see farther back in time in an effort to discover the origins of the universe. The way they do this is through the use of telescopes to observe celestial objects that lie at great distances from the Earth. Due to certain scientific occurrences, the more distant the objects that we are able to view, the further back in time we are looking. The way we implemented this context was by developing an interactive simulation in which students can view the night sky from different locations on Earth and in space using increasingly more powerful viewing instruments. Each student takes on the role of an observer on the Earth who is using various viewing instruments to view the night sky. As the program progresses they learn more about telescopes, including their advantages, limitations, and the factors that influence their operation.

From the start we also wanted to incorporate many of the stunning images that have been provided by the Hubble telescope. This includes images from the farthest reaches of space that have never before been seen – images that have captivated people all over the world since they were made public. This fit in perfectly with our simulation because the final scene of the simulation would allow students to use the Hubble to view celestial objects.

Our design project may currently be found at: http://www.albyers.com/CONNECT/index.htm. The NASA Langley Learning Technology Program Manager is now overseeing the formative review and revision of our content and design. In hindsight, the design process may have been simplified if: (a) the graduate student instructional designers could have coaxed more salient program objectives from the NASA subject matter experts, and (b) more time could have been allowed to conduct early formative revision of the product, such as expert reviews, one-on-one student reviews, small group and pilot testing.

Student Progression and Interaction through our "Virtual Lab"

The virtual lab begins with a Web-based introductory section that introduces students to the idea of looking back in time. Inquiry questions are used to gain attention and provide an advance organizer to help direct students' attention. The types of questions include, "Where did the human race come from?", "How did the Earth come into being?", and "When did the universe begin?" these types of questions help lead students into taking on the role of a curious astronomer. It is also a way of gaining the students' attention through the use of decorative images produced by the Hubble telescope.

The completed instructional program/virtual lab contains three separate simulation scenes of increasing depth and interactivity, surrounded by a variety of supporting instructional materials. The simulation portions of the virtual lab were developed in Macromedia Director and then exported as a series of Shockwave movies, while the supporting material was developed as Web pages. Director was chosen for its ability to easily combine different graphical elements with sound effects, as well as for its animation capabilities. Director's Lingo programming language was utilized extensively to control the switching of graphics as well as the movements of the various telescopes across the viewing window.

The simulation part of the virtual lab comprises three different interactive "scenes". In the first scene students begin on Earth using only their naked eyes to view the night sky. In addition, they have a choice of three different viewing locations: mountain, desert, or city. Each location provides a different level of viewing depending on several factors. At the end of this scene students have learned the optimal Earth-based location for viewing the night sky, as well as the various obstacles that can make viewing more difficult.

Once the student has determined the optimal viewing location, this leads into the next scene of the simulation. In this second scene students are limited to one Earth-based location, but they are now given the option of using several different viewing instruments with which to observe the sky, including a telescope and a larger mountaintop observatory. It is at this point that they are introduced to the concepts of right ascension and declination. This is the coordinate system that is used by astronomers to locate objects in the sky using telescopes. Since students now have the use of two different telescopes we programmed the simulation so that students must first choose which telescope

they wish to use, and then decide which part of the sky they wish to view using their selected telescope. After determining where they wish to point their scope, they must enter the appropriate coordinates (in the form of right-ascension and declination) for that location in an entry window in order to move the telescope to that location. The telescope viewer then moves to that location in the sky. If there is an object to see at that location it appears within the scope. If a student clicks on the scope at that point he or she will then see an enlarged picture of the object. These pictures are actual NASA photographs that approximate what the object would look like using that particular telescope.

By focusing the scopes on different sections of the sky students are able to view various celestial objects, some of which are not viewable with the naked eye. Those that *are* viewable with the naked eye are seen in much greater detail when using one of the telescopes. By the end of this scene students will have learned that telescopes allow us to view celestial objects in much greater detail than we can using just our eyes, and that even more powerful telescopes allow us to view new objects that are farther away from the Earth, and thus farther back in time. At end of this scene, however, students realize that there are limitations even with mountaintop observatories, and that astronomers have still not been able to see all the way back to the origin of the universe.

This leads to the third scene of the lab, in which students blast off into space to view celestial objects without the impediment of the Earth's atmosphere. At this point they have advanced to using the Hubble telescope, and can view the same objects as before in the greatest detail available to us. In addition, the use of the Hubble opens up the sky to allow them to view even more distant objects, including objects that have never been seen before: start clusters, great spiral galaxies, and brilliant nebulae. In programming this scene we were able to make use of many of the breathtaking images captured by the Hubble telescope.

Supporting Sub-lessons within the "Virtual Lab"

In addition to discussing the operation of telescopes, we chose to include other concepts that were deemed important to the overall context of the program. They were chosen based on how well they could be incorporated into the concepts covered in the simulation scenes. We did not want to give the impression that the simulation was "stopping" while we fed the students needed verbal information. The goal was to make it seem as though students were interacting with a continuous instructional program.

These concepts are introduced during Web-based "sublessons" that fall between the three different simulation scenes. At the end of each simulation scene students enter one of these sublessons, where they are first presented with a review of the concepts covered in the previous scene. After that, new concepts are introduced that will enable students to progress to the next scene of the simulation. For example, before moving on to the scene that features the Hubble telescope, students first go through a sublesson that discusses what the Hubble telescope is and why it is important to astronomers. In doing so students understand that when astronomers reach the limits of what they can observe in the sky, they must turn to new technologies to enable them to see further and thus continue their cosmic quest to discover the origins of the universe. Colorful graphics, Shockwave animations, and JavaScript quizzes are employed in the sublessons to help keep students interested throughout these non-simulation segments of the program. In addition, these sublessons are where we chose to integrate the various math concepts that were deemed important by the NASA team.

Keeping Track of Cosmological Time in the "Virtual Lab"

During the development process it was important for us to keep in mind the ultimate goal of students' celestial observations, which is to search back in time for the origins of the universe, and galaxies in particular. To that end we integrated a way for students to keep track of how far they have progressed in this quest. Throughout the program they keep track of their progress through the use of a chronometer. The chronometer is a graphical representation of how far back toward the origin of the universe students have been able to view at that point in the simulation. The chronometer is updated throughout the program as a student progresses to using more advanced telescopes, and thus is able to see more distant objects. At the end of each part of the simulation students see that there is still farther to go, and that we need to use more advanced techniques in order to keep traveling back in time. This progressively leads to the subsequent sections.

No Answer in Sight: The Need for the Next Generation Space Telescope

At the end of the program students can see from the Chronometer that there is still farther to travel in order to see back to the origins of the galaxies, and that new advanced telescopes must continually be developed to help astronomers in their quest. Students realize that we are continually limited in our knowledge of certain scientific questions, and that our knowledge and understanding is limited by the power of our observations. The program then finishes up with a discussion of several advanced telescopes that are currently being developed and/or deployed. These next generation telescopes are necessary to help us answer the complex questions posed to us by the universe around us, and to provide greater explanatory insight into the cosmological origins of the universe.

Will any of today's students become tomorrow's astronomers? It is hoped that programs such as this, and the many others provided by NASA CONNECT, will help to stimulate student interest in science, mathematics and technology, and by doing so help shepherd in a new generation of space explorers, scientists, and engineers who will attempt to solve these challenging endeavors.

In Closing:

This paper analyzed the instructional design process employed to develop a "Virtual Lab" in support of the NASA Langley CONNECT distance education program. NASA CONNECT is a series of educational programs developed by the NASA Langley Research Center that employ multiple ways to engage middle school students in learning standards-based mathematics, science and technology using NASA content. The CONNECT programs employs multiple modes of delivery and student interaction via web-based virtual labs, classroom inquiries and video-facilitated student discourse.

Our interactive shockwave-based project in support of a NASA CONNECT "Virtual Lab" is described in detail and the design decisions that transpired are reflected upon. Internet URL's are also provided throughout our document for readers to access not only the NASA CONNECT program, but also our existing version of the project, as well as how to obtain prior NASA CONNECT programs via NASA's Central Operations of Resources for Educators.

Acknowledgments:

We would like to thank the NASA Langley Education Office for their cooperation in allowing us the opportunity to assist them in developing educational content for the NASA CONNECT education program. In working with authentic educational programming we were able to apply the skills learned in instructional design as well as Macromedia Director and Lingo programming. We would especially like to thank Jeff Seaton, Learning Technologies Project Manger at NASA Langley for having faith in our ability to create a working prototype for the NASA CONNECT web component and Dr. John Burton, Full Professor at Virginia Tech for mentoring us through the instructional design and Macromedia Director landscape.

Digital Storytelling: Creating Multimedia Narratives as School Projects Using Desktop Movies

Kate Kemker
Brendan Calandra

Today, teachers in traditional classrooms are inspiring their students through the discovery of desktop movie making. Desktop movie projects are a powerful way to teach across curricula as students create their own videos. Producing desktop movies engages critical and creative thinking in order to plan and produce programs (Jonassen, Peck, & Wilson, 1999). Digital storytelling projects, for example, demand a project synopsis, storyboards, a shooting script, and a production log (as well as development of the actual media) (Apple, 2000). Students need only a camera, a computer, Final Cut Pro and their imagination to create their own digital story.

A Scenario

A schoolteacher somewhere in the U.S. began one of her classes with an opening lesson on the Holocaust. Her application of multimedia tools and content, however, made this year's exploration of the historical event a memorable one for her students. Through the utilization of the Web site *A Teachers' Guide to the Holocaust*, students embarked on virtual field trips to concentration camps, and to far away museums and other historical sites. The students were also able to view video clips of Holocaust survivors and listen to traditional Jewish music of the time period. After touring virtual exhibits on the Web, students then broke into groups to begin discussing different aspects of the Holocaust.

Group A decided to focus on the music that came out of the Holocaust using MIDI (digital music) and text files of lyrics from traditional Jewish and partisan resistance songs. Group B chose to focus on the Treblinka extermination camp. They collected images from Web galleries, examined interactive maps, took virtual reality tours of the camp, and researched original documents created by victims, perpetrators and others. Group C wanted to look at the Holocaust from a child's perspective. Group C decided to use a collection of children's drawings, poems, and diary entries from the Terezin concentration camp to create a multimedia collaborative project through which they would try and better understand the sad stories of children caught in the horrors of the Holocaust.

The group elected to create a digital video to be presented to their class. The subject once taught through traditional textbooks had been transformed. The project integrated technology, connectivity, content and human resources in the production of a digital story describing events during the Holocaust as seen through children's eyes. Motivation was high throughout due to the pride students took in the development process and the final product.

Desktop Movie Making

Advances in desktop computer technology make it possible to capture and manipulate sounds, video, and special effects to create a single presentation (Alessi & Trollip, 2001). This innovative technique is called desktop movie making. The use of desktop movies as a medium for student collaborative projects engages them in planning, writing, visualizing, organizing, creating, and a host of other meaningful learning activities (Jonassen, Peck, & Wilson, 1999).

In television journalism, the video essay serves as an alternative to traditional narrative or voice-over modes of presentation. A video essay follows an underlying theme or storyline and presents information entirely through video. This type of story format is similar to digital storytelling. One difference is that the desktop movie editing process is simple enough that almost anyone can do it.

Traditional linear video editing involves viewing the video from the beginning and then cutting the tape as you go along. This process involves a variety of equipment and is very time consuming. With the creation of non-linear editing systems, such as Final Cut Pro, video editing can now be done on the computer. The term "non-linear" refers to the random access capabilities for searching, recording, and playing back digital video sequences stored on the computer's hard drive. With a nonlinear editing system, you can begin editing at any point in a video. The information stored on a hard drive may be accessed, nearly instantaneously, at any point from any point on the hard drive. When students are engaged as producers of media, there is more learning taking place than when students are receivers of media (Alessi, S. & Trollip, S., 2001).

Conclusion

Today, teachers in traditional classrooms are inspiring their students through the discovery of desktop movie making. Desktop movie projects are a powerful way to teach across curricula as students create their own videos. Producing desktop movies engages critical and creative thinking in order to plan and produce programs (Jonassen, Peck, & Wilson, 1999). Digital storytelling projects, for example, demand a project synopsis, storyboards, a shooting script, and a production log (as well as development of the actual media) (Apple, 2000). Students need only a camera, a computer, Final Cut Pro and their imagination to create their own digital story. Like the invention of written language, the potential of using desktop movies in the classroom, in which the students are able to create their own movies, seems to represent a major landmark in human history (Forman, & Pufall, 1988).

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Developing Web -based Multimedia for an Educational Web -site: The Use of Quicktime Audio, Video, VR technology and JavaScript-based Interactivity

Brendan Calandra
Kate Kemker
Ann Barron
Christine Harmes

Abstract

The *Teacher's Guide to the Holocaust* is an instructional Web site comprised of over 7,000 HTML pages using a wide range of digital media from text to video and virtual reality. It was designed and developed by graduate students in the Instructional Technology program and the staff of the Florida Center for Instructional Technology, at the University of South Florida. The program was designed to provide a one-stop resource for teachers of the Holocaust.

A variety of media was used in developing the *Teacher's Guide*. The media ranges from text files to video and JavaScript based interactivity. This paper briefly describes the design and development of the following multimedia elements of *A Teachers' Guide to the Holocaust*: Interactive Quizzes, Digital Audio and Video, Java Script-Based Glossary Widows, and Virtual Reality Panoramic Pictures.

Introduction

In 1994, Florida became the first state to enact a law requiring instruction in the history of the Holocaust (Brogan, 1997). The law was championed by, among others, Stephen Spielberg, director of Schindler's List. The law requires that all public schools teach the following:

> The history of the Holocaust (1933-1945), the systematic, planned annihilation of European Jews and other groups by Nazi Germany, a watershed event in the history of humanity, to be taught in a manner that leads to an investigation of human behavior, an understanding of the ramification of prejudice, racism, and stereotyping, and an examination of what it means to be a responsible and respectful person, for the purposes of encouraging tolerance of diversity in a pluralistic society and for nurturing and protecting democratic values and institutions.
>
> The Holocaust Education Bill (SB 660)

Although the law mandated Holocaust education, very few of Florida's teachers were adequately prepared to teach this sensitive subject. To help meet the need for teacher preparation and curriculum resources, the Florida Center for Instructional Technology, along with the Instructional Technology program in the College of Education at the University of South Florida, created the online resource, *A Teacher's Guide to the Holocaust* (http://fcit.coedu.usf.edu/holocaust).

The *Teacher's Guide* is designed to provide an overview of the Holocaust through text, original source documents, graphics, photographs, art, movies, and music. This Web site allows preservice and inservice teachers to view the Holocaust through three different "lenses"--Timeline, People, and the Arts. Additional resources are provided in the Student Activities and Teacher Resources sections.

Multimedia

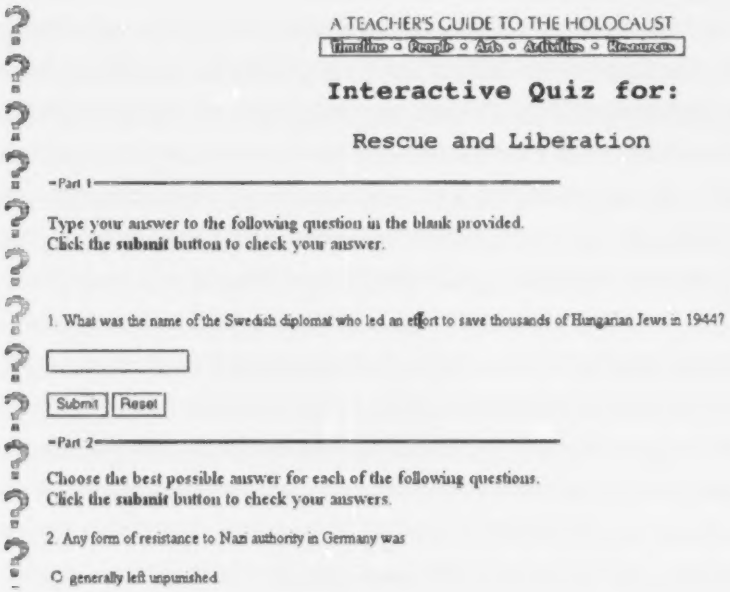
Multimedia is the use of several media to present information. Advances in digital technology in the last decade have led to the ability to develop multimedia more conveniently and at higher levels of sophistication than ever before. These advantages impact the field of education due in part to the richness of context that multimedia can provide and also to the range of formats in which information can be presented (i.e. text, graphics, video.) Because of its universal availability and dynamic nature, Web -Based Instruction has also grown rapidly in all facets of education. Due to the recent explosion of interest in Web -Based Instruction in education, researchers and practitioners are scrambling to find proven methods for turning Web sites into effective learning instruments.

A variety of media has been used in developing the Teacher's Guide. The site provides over 1,000 photographs, hundreds of source documents, numerous panoramas of concentration camps, music, survivor testimony videos, interactive quizzes, interactive glossaries, and many other resource materials for Holocaust instruction. All of these resources included in the site can be readily used in classrooms for instructional purposes. This paper briefly describes the design and development of the following multimedia elements of *A Teachers' Guide to the Holocaust*: interactive quizzes, digital audio and video, Java script-based glossary widows, and virtual reality panoramic pictures.

Development

Several techniques were used to create the vast array of resources available on the site. A few of these resources that will be discussed in more detail below are: Interactive Quizzes, Digital Audio and Video, JavaScript-based Glossary Widows, and Virtual Reality Panoramic Pictures.

Interactive Quizzes


A TEACHER'S GUIDE TO THE HOLOCAUST

Timeline ◦ People ◦ Arts ◦ Activities ◦ Resources

Interactive Quiz for:

Rescue and Liberation

-Part 1-

Type your answer to the following question in the blank provided.
Click the **submit** button to check your answer.

1. What was the name of the Swedish diplomat who led an effort to save thousands of Hungarian Jews in 1944?

Submit Reset

-Part 2-

Choose the best possible answer for each of the following questions.
Click the **submit** button to check your answers.

2. Any form of resistance to Nazi authority in Germany was

○ generally left unpunished

In order to provide immediate, client-side feedback and a mild level of interactivity, quizzes were developed using Macromedia's CourseBuilder ®. This software allowed items to be created quickly and easily using a variety of formats including, radio buttons, check boxes, drag-and-drop and more. Feedback was provided in the form of pop-up dialogue boxes with comments such as, "Good job," or "Try again." In some circumstances, feedback was provided in the form of correct answers provided at a prescribed time during interactions. Questions were created in a variety of formats ranging from multiple-choice to short answer and drag and drop. Question content was created and validated by a team of Holocaust and measurement experts working on *The Teachers' Guide*.

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QuickTime Audio

A TEACHER'S GUIDE TO THE HOLOCAUST

Timeline ◦ People ◦ Arts ◦ Activities ◦ Resources

Traditional Jewish Music

The following traditional Yiddish and Hebrew selections can be played in MIDI:

Oyfn Pripetshik

This well-known Yiddish lullaby, by Mark Warshawsky (1848-1907) describes a rabbi teaching a group of kindergarten-aged boys the Yiddish alphabet. It is symbolic of the Jewish tradition of studying Torah, the Five Books of Moses, as well as the passing down of heritage from one generation to another.

Yiddish	English
Oyfn pripetshik brent a fayer,	Oh, the fire burns in the fire place,
Un der rebbe lernt kleyne kinderlech dem alefbeyz,	And the rabbi teaches all the little ones all their ABCs;
Un der rebbe lernt kleyne kinderlech dem alef-beyz.	And the rabbi teaches all the little ones, all their ABCs
Zet zhe, kinderlech, gedenkt zhe tayere, vos ir lernt do,	See now, little ones, listen children, don't forget it, please
Zogt zhe noch a mol un take noch a mol Komets alef o.	Say it once for me and say it once again, All your ABCs

Paper manuscripts of music used on the site were accessed from the public domain archive at the university library. A musician was then hired from our university to create digital sound files on a MIDI keyboard. The MIDI file was then saved as a QuickTime file in order to make it universally accessible (A QuickTime installer was placed on all CDs and a link to QuickTime download on our site.) Multimedia that is created in QuickTime will perform equally as well on Windows and Macintosh computers.

Quicktime Movies

A TEACHER'S GUIDE TO THE HOLOCAUST

Timeline ◦ People ◦ Arts ◦ Activities ◦ Resources

Sylvia Richman

Sylvia Richman tells about life in a Jewish ghetto in Poland.

MOVIE "I was born in a country called Poland."

MOVIE "By being Jewish, we were threatened."

MOVIE "All the Jewish people had to move."

Holocaust survivor movie files were originally recorded by an analog video camera at the Tampa Bay Holocaust Museum. Permission was granted from each of the survivors to use the video footage on the Web site. The VHS videotapes were then transferred to a digital video camera, allowing the movies to be edited on a computer. Each one of the videos was then reduced to short one-minute clips. The clips were edited according to content. Each video clip is a stand-alone idea listed by description on the site. Finally, the movies were compressed to reasonable file sizes for use over the Web.

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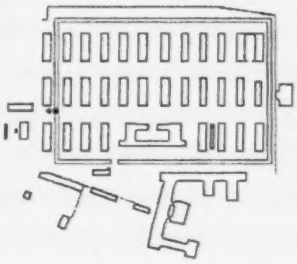
Quicktime VR

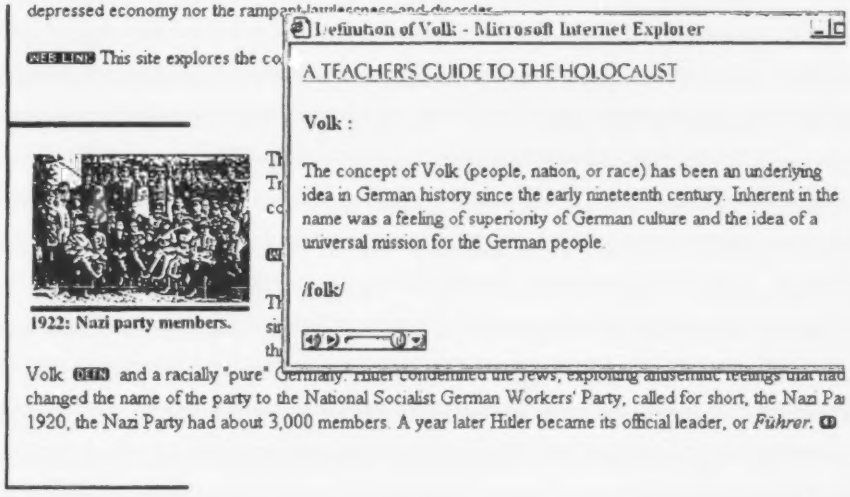
A TEACHER'S GUIDE TO THE HOLOCAUST
Timeline ○ People ○ Arts ○ Activities ○ Resources

VR Movie: Auschwitz Gas Chamber



QuickTime VR (QTVR) allows for an immersive user experience that simulates three dimensional objects and environments. The QTVR panoramas used on the Holocaust Web site provide experiences such as standing at the Auschwitz Gas Chamber or walking through the camp grounds. To create a QTVR panorama, the photographer stood in one place, with the camera on a tripod, and took pictures in succession, as the camera was rotated 360 degrees. The pictures were then stitched together using Apple's QuickTime Virtual Reality Authoring Studio. Each QTVR was created in three file sizes for use with different Web connection speeds.

Interactive Glossaries


depressed economy nor the rampant lawlessness and disorder
WEB LINK This site explores the co
Definition of Volk - Microsoft Internet Explorer
A TEACHER'S GUIDE TO THE HOLOCAUST
Volk :
The concept of Volk (people, nation, or race) has been an underlying idea in German history since the early nineteenth century. Inherent in the name was a feeling of superiority of German culture and the idea of a universal mission for the German people.
/folk/
1922: Nazi party members.
Volk DEFN and a racially "pure"
changed the name of the party to the National Socialist German Workers' Party, called for short, the Nazi Pa
1920, the Nazi Party had about 3,000 members. A year later Hitler became its official leader, or Führer.

Definitions are provided for those words of which users might not have complete knowledge and understanding. The user simply clicks on the semiotic icon "DEFN', and a JavaScript pop-up window opens. The definition of the vocabulary word appears in the window along with a sound clip of the word being spoken in its native language. Students at the university provided the sound clips. The JavaScript was hand coded and embedded into HTML files. The Audio files of pronunciations were created in QuickTime. JavaScript is an easy to learn scripting language that enables creations of activities that have responses such as pop-up boxes, status bar messages, and validation and feedback based on form data.

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Implementation

The primary vehicle for distribution of the project is the Web. The Florida Center for Instructional Technology maintains a Windows NT Web server at USF. File management and maintenance are monitored closely, and revisions and updates can be done on a routine basis. The Web site currently receives over two million hits per month, and links to it have been established from hundreds of Web sites throughout the United States, Europe, the Middle East, and other parts of the world.

Although delivery through the Web is optimal in many circumstances, there were sufficient reasons to create a version of the program for delivery on CD-ROM. One of the major restraints of Web delivery is that not all teachers have access to the Web. Another problem was that more sophisticated multimedia demands higher bandwidth than most people have at home and many have at their schools. Therefore, a CD-ROM-based version was created and distributed to every school in the state of Florida. Because of the need for distribution via the Web and CD, all of the files were client-based and all of the links were relative

Conclusion

Advances in technology in the past decade have allowed for multimedia to be developed more efficiently and at higher levels of complexity than ever before. The implications for the use of multimedia in education stem from the richness of context and variety of formats for the presentation of information that especially digital multimedia can now provide. The World Wide Web (WWW) is fast becoming the widest reaching means of communication in the world. Through the WWW, digital multimedia can be disseminated across barriers of time and space. The examples provided above are only a few of the creative ways in which specifically instructional multimedia material can be developed for and implemented using the WWW.

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Successfully Integrating Technology into a Lesson Plan for a Technology-Rich Learning Environment

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The successful integration of technology into a lesson plan that enhances the learning environment is a mixture of numerous significant elements. These elements build upon the strengths of numerous entities. Two significant groups of instructional designers who have come together to develop the technology-rich lesson plans are teacher candidates and inservice educators. Yet the thoughtful design of a lesson plan format with simplistic explanations and examples offers the ease of use that is necessary for persons who are working within a new philosophical world of integration. Further, the assessment module that must follow the lesson plan design and development must offer an ease of use that enriches the discussion surrounding the lesson plan assessment mode. An assessment rubric was developed that met the desires of all parties concerned.

An Adaptive Hypermedia Presentation Modeling System for Custom Knowledge Representations

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Abstract. We propose a generic presentation system for adaptive educational hypermedia that is highly independent from domain knowledge representation and application state management. Our approach is based on providing a) a module for knowledge representation by means of the definition of domain ontologies that best fit specific domains and/or authors, b) a module for building courses by constructing semantic networks of interrelated domain ontology instances, and c) a presentation module where presentation models (templates and rules) are associated to ontology object classes and relations. By using an explicit presentation model, separate from course contents, course designers are provided with extensive control over the generation of all aspects of presentation, at a moderate development cost. Because minimum assumptions are made about how domain knowledge is structured and updated, our presentation system can be potentially integrated with a wide range of adaptive hypermedia support tools.

1 Introduction

With the rapid introduction of web-based technology in the educational field, learners are gaining increasing autonomy, and instructional applications are reaching an unprecedented diversity of users. In this context, a growing interest has been raised for the development of hypermedia systems that are able to adapt automatically to different types of users, platforms and situation, and that take into account the evolution of each user over time (Brusilovsky 1998b). A common implicit or explicit priority concern to all research work in adaptive education is that of finding an appropriate representation for pedagogical knowledge (Murray 1998). Each courseware development tool establishes its own way to structure the domain, so that designers must describe the subject matter as the tool prescribes, and the tool takes care of the selection, presentation and dynamic sequencing of teaching materials, and the interaction with the user.

In this paper we propose a generic hypermedia presentation system, PEGASUS (Presentation modeling Environment for Generic Adaptive hypermedia SUpport Systems), that makes minimum assumptions about how instructional knowledge is represented (Macías 2001a, 2001b). It is our purpose to provide courseware designers with a simple specification paradigm for non-trivial adaptive presentation constructs, that can be used with different course management systems. In order to allow for different approaches, PEGASUS supports the definition of made-to-measure domain ontologies for the description and conceptual structuring of subject matter (as in Murray 1998). Once an ontology is defined, designers build courses by creating domain objects and relating them together using the conceptual vocabulary defined by the ontology. Course presentation is designed by defining an explicit presentation model where presentations are associated to ontology object classes and relations.

2 Related Work

The explicit representation and use of semantic knowledge about a domain to facilitate or guide the access to information has been a primary concern in hypermedia systems from the early times (Trigg 86). In the literature on adaptive hypermedia many ways to structure knowledge have been proposed. Most of them are based on a level of contents, discretized on the basis of some kind of elementary unit, and a level of semantic structure, that is used as a road map to guide navigation. There is a great variation however as to how contents are structured, how the conceptual network is organized, and how both levels are connected.

To name a few, Interbook (Brusilovsky 1998a) structures courses into hierarchical aggregate units: *chapters*, *sections*, *subsections*, and *terminal pages*, accompanied by a set of interconnected *concepts* with two types of relation: *prerequisite* and *outcome*. The relative simplicity of this two-relation model contrasts with the lexical richness of other tools like HyperTutor (Pérez 1995), where the conceptual map takes a wide variety of relations from the educational theory literature: *prerequisite*, *sequence*, *aggregation*, *similarity*, *opposite*, *example*, *specialization*, and *exception*. AHA (De Bra 1998) allows a more flexible composition of pages, based on conditional HTML fragments. Concepts have three boolean attributes to indicate the student's state of knowledge with respect to each concept: *known*, *read*, *ready to be read*, and relations between concepts have a parameter that represents a state (a boolean) or a quantitative measure (a number).

DCG (Vassileva 1997) and TANGOW (Carro 1999) are distinguished for generating the course structure, or parts of it, at runtime. In DCG a first level of interconnected concepts is defined, below which, for each concept, a tree of learning *tasks* and *subtasks* is created with the sequence of documents and actions to follow by the student to learn the concept (Vassileva 1995). Both task decomposition and the association of fragments to atomic tasks are determined dynamically at runtime by means of *rules*. TANGOW uses a conditional hierarchy similar to DCG where, unlike DCG, contents can also be associated to composite tasks which, as a consequence, can also be visited by the student. In other systems, the generation of semantic relations is even more dynamic and takes place by means of automatic search mechanisms based on metadata that are associated to information units (Wilkinson 1999). This approach is useful when the knowledge space is too large and/or volatile to define and maintain explicitly the desired relationships.

Out of the hypermedia field, Eon (Murray 1998) takes a more general approach than the preceding systems, allowing the author to define his/her own knowledge categories (*topics*), and the relations among them that s/he considers appropriate. Each topic is assigned sets of content units through different relations defined by the designer, such as *introduction*, *explanation*, *evaluation*, *basic level*, *advanced level*, or *summary*. The effective selection of contents takes place at runtime by applying predefined pedagogical strategies for content selection and ordering (e.g. choose an element randomly, or present all of them in sequence). Eon provides a graphical tool where the designer builds parameterized user interfaces, to which s/he associates units of contents, in such a way that interface widgets (buttons, tables, graphs, dialog boxes, etc.) take values from the knowledge unit being presented.

3 Knowledge Representation

Using a specific knowledge representation approach, like the ones described in the preceding section, a domain model is built. Many adaptive systems associate information about the student to domain model objects, in order to maintain an up-to-date model of the student's knowledge and goals with respect to the described subject matter (overlay model). This information is used at run-time to adapt the selection and presentation of contents and links to the user. While the cited systems provide for different forms of explicit author control over the teaching strategies (corresponding to conceptual map update mechanisms), the generation of pages, except in Eon (Murray 1998), is done according to fixed presentation patterns and styles programmed into the tool.

Our system supports the automatic generation of hypermedia documents of the type supported by other adaptive systems, with full control for the designer over the visual aspects (presentation) of the generated hyperdocuments, and without imposing a particular representation of knowledge. To do so, like Eon, PEGASUS allows the definition of taxonomies made to fit the domain and/or the author. The terminology thus defined is used on the one hand for the description of the subject matter by the author, and on the other for the construction of presentation models associated to the different knowledge categories.

3.1 Domain Ontology

The domain ontology in PEGASUS consists of a set of classes that best fit a specific application domain or that reflect the specific view of a particular author on the domain. In our approach ontologies can be defined with a high degree of freedom, with very generic classes like Concept, Lesson, Fact, or more specific, like Algorithm, Theorem, or Definition, as the designer sees fit. Ontologies include terms for subject-matter information (e.g. a theorem has a statement and a proof), pedagogical information (e.g. lessons have levels of difficulty), and run-time (user and system) state information (e.g. whether a concept is known by the student). All this knowledge is captured by defining attributes for classes, and relations between classes.

PEGASUS provides a root class, *KnowledgeUnit*, and two predefined subclasses, *Topic* and *Fragment*, for ontology designers to subclass. *Topic*'s are presented to the end-user in a separate page, while several *Fragment*'s can be inserted in the same page. A predefined subclass of *Fragment*, *AtomicFragment*, carries content media (HTML source). *KnowledgeUnit* has a few predefined attributes like *id* and *title*, to which the designer can add others like *read*, *known* or *visible*, and new relations like *prerequisite* and *subunit*. Among other formats, PEGASUS allows the representation of ontology classes and domain instances in XML. The following example illustrates the definition of a class *Algorithm* with three relations: procedure, examples, and proof of correction. For the sake of brevity we omit here other relations that would normally be included, such as previous definitions, problem to solve, or analysis of complexity.

```
<Class name="Algorithm" parent="Topic">
   <Attribute name="recursive" type="Boolean"/>
   <Relation name="procedure" type="AtomicFragment"
             multivalued="false" title="Procedure"/>
   <Relation name="examples" type="AtomicFragment"
             multivalued="true" title="Examples"/>
   <Relation name="correction" type="Theorem"
             multivalued="true" title="Proof of Correction">
      <Attribute name="relevant" type="Boolean"/>
      <Attribute name="difficulty" type="Number"/>
   </Relation>
</Class>
```

Relations can have their own attributes, like the difficulty of the proof of correction in the above example, that reflect properties of the relation itself. All relations have a predefined *title* attribute that is used in certain cases to generate titles or text for hypermedia links.

In addition to a domain ontology, simpler data structures are defined by the designer to describe user profiles, information about the course (plan, goals, requirements, duration, number of students, etc.), platform characteristics and other aspects considered relevant for the adaptivity of the application being built.

3.2 Domain Model

Once an ontology has been defined, courses are constructed by creating semantic networks of domain objects, using the classes and relations defined in the ontology. The following example illustrates the creation of an instance of *Algorithm* to represent Dijkstra's algorithm for the shortest paths problem (we assume that the attribute *title* and the relation *prerequisite* are predefined in the root class *KnowledgeUnit*).

```
<Algorithm id="Dijkstra" title="Dijkstra's Algorithm" recursive="false">
   <prerequisites> <Algorithm ref="relaxation"/> </prerequisites>                    (1)
   <procedure>
      <AtomicFragment> <tt>Dijkstra(G,s)<br> Init(G,s)<br> Q = V[G]      (2)
      <br>  while Q not empty do<br>  u = ExtractMin(Q)<br>
        for v in Adj[u] Relax(G,u,v)</tt> </AtomicFragment>
   </procedure>
   <examples> <AtomicFragment URL="exmpl.html"/> </examples>                          (3)
   <correction relevant="true" difficulty="0.6"> <Theorem ref="th1"/> </correction>
</Algorithm>
```

Elements with the attribute `ref` indicate references to other course units (for instance, line 1 refers to an algorithm with `id="relaxation"` which is assumed to be defined somewhere in the domain model). Atomic fragments can directly consist of a string, like Dijkstra's algorithm procedure above (line 2), or a web address, as in line 3.

At runtime PEGASUS maintains a copy of all domain objects for each user, where class attributes (e.g. *read*) are used to measure the user's progress. These values can be used to influence presentation (see Section 4), but a complementary update module is required to keep them up to date (see architecture, Section 5).

The domain model in PEGASUS supports the definition of adaptive elements in the model itself by means of the introduction of conditions on any part of the structure. For example, in line 3 different examples could be given to select from depending on the student's experience level. This way it is possible to build dynamic structures like TANGOW (Carro 1999) or DCG (Vassileva 1997) task hierarchies, which take their definitive shape at runtime depending on the user model. Besides these adaptive elements, PEGASUS admits, though does not include by itself, any other mechanism for dynamic construction and modification of course structure. Our system takes care of how this may affect presentation, but how course structure and state are updated is external to the presentation system.

4 Presentation Model

Existing adaptive hypermedia systems miss an explicit presentation model. As a consequence, presentation is partly intermingled with contents (as in De Bra 1998), and partly set up automatically by the system according to rigid design choices (e.g. link annotation) that the designer cannot configure (see Brusilovsky 1998a, Carro 1999, for instance). In PEGASUS, the separation of content and presentation is achieved by defining a *presentation template* for each class of the ontology. Templates define what parts (attributes and relations) of a knowledge item must be included in its presentation and in what order, their visual appearance and layout. Templates are complemented with *presentation rules*, which are responsible for generating adaptive presentation constructs involving relations between domain objects from very succinct high-level descriptions given in templates. Whereas in Eon (Murray 1998) user interface components are associated with specific units of knowledge, in PEGASUS presentations are defined for *categories* of knowledge.

4.1 Presentation Templates

Templates are defined by using an extension of HTML based on JavaServer Pages™ (JSP) (Sun 2001), that allows inserting control statements (between <% and %>) and Java expressions (between <%= and %>) in the HTML code. In these templates, the designer can use all the presentation constructs of the HTML language (lists, tables, frames, links, forms, etc.), and insert, using very simple Java expressions, the domain items to be presented. For instance, a very simple template for class *Algorithm* could be as follows:

```
<h2> <%= title %> </h2>
<h3> Previous concepts </h3>
<%= prerequisites %>
<h3> Procedure </h3>
<%= procedure %>
<h3> Examples </h3>
<%= examples %>
<h3> Proof of Correction </h3>
<%= correction %>
```

In these templates the presentation author only needs to refer to attributes and relations of the presented class (shown in bold in the example). The presentation system takes care internally of aspects like automatically handling lists (multivalued relations like the examples of an algorithm), or recursively applying templates to referenced objects according to their class (e.g. the proof-of-correction *Theorem*'s of an algorithm). The resulting page for Dijkstra's algorithm with this presentation template can be seen in Fig. 1. HTML elements surrounding the algorithm presentation (frame structure with contextual index on the left and *Previous / Next* buttons at the bottom) come from the presentation template for the root class *KnowledgeUnit*.

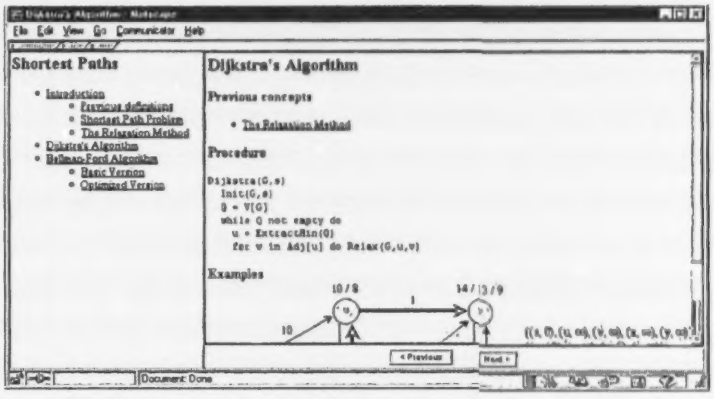

Figure 1: Generated web page for a topic of type *Algorithm*

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The template definition language supports the introduction of adaptive elements by using conditionals. For instance, in lines 4 to 7 in the preceding example, the presented information could be conditioned to the student's level of expertise, including all available examples when the student is a beginner, and a single example for more advanced students, showing the proof of correction only if it is relevant and not too difficult for the student. The expression language for templates includes other facilities that allow, for instance, cutting down, filtering or sorting lists according to an arbitrary comparison function, generating trees and linked lists by traversing a relation, or forcing the generation of hypermedia links. The basic template language allows the specification of a wide set of non-trivial presentations by using a very simple syntax. However the designer can write arbitrarily complex Java code inside the templates themselves.

4.2 Presentation Rules

Presentation rules govern aspects like link generation, correspondence between link styles and topic states, ordering and layout of (fragment or link) lists, and the generation of built-in presentations for topic network subsets like linked lists and trees. When, like in the previous subsection, the designer refers to a relation like *prerequisite* in the template for class *Algorithm*, rules take care automatically of deciding whether to insert prerequisite details in the generated page, or to generate a link for each prerequisite, which style and annotation are used in the latter case, and how all the pieces are laid out. In doing so, the system analyzes whether the relation is simple or multivalued, the class of the involved topics or fragments, their state, and other conditions, if any, stated by the designer. The designer can modify existing rules and define her/his own. See (Macías 2001b) for a more detailed description of PEGASUS presentation rule definition and processing.

5 Architecture

At runtime, the student interacts with the application from a web browser. The interaction with an application built with PEGASUS consists of traversing the domain object network. Each time the user moves to an object, PEGASUS responds by generating an HTML page. In doing so the system 1) resolves the user's request by determining the actual object to move to, 2) locates the instance in the domain model, 3) updates the domain and user models, 4) generates the HTML presentation applying the pertinent rules and the template that corresponds to the object class. In the generated pages links do not point to other pages but refer, explicitly or descriptively, to other domain objects.

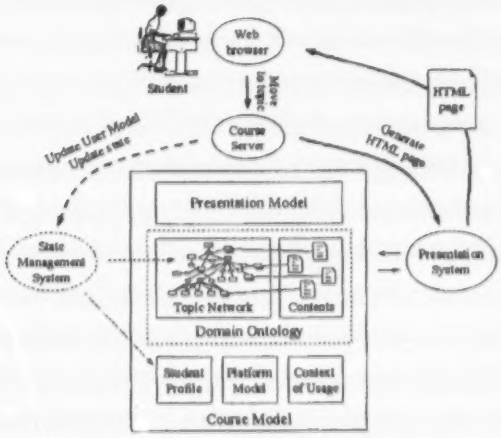

Figure 2: Course model and system architecture

In most cases our presentation system will not work alone, since steps 1 and 3 above are external to PEGASUS. After an ontology for the subject matter is built, a runtime module is needed to set up and/or update topic networks (step 3), as illustrated in Fig. 2. Optionally, a planner can be included like in DCG (Vassileva 1997), to determine the path to follow in response to user's requests (step 1).

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6 Conclusions

The proposed knowledge representation system can reproduce the domain models used in a wide range of hypermedia systems. Because the dynamic generation of presentation is a separated mechanism from the application state update mechanisms, PEGASUS is compatible with different courseware support tools like the ones described in the related work section. Our approach allows the specification of presentation independently from content construction, enhancing presentation reuse and consistency, thus reducing the development cost.

While the construction of templates is within reach of any web page designer who is familiar with HTML and JSP technologies, the definition of ontologies is a delicate task that requires the participation of an advanced designer, trained in using our system. Once the ontology and the associated presentation models are defined, the construction of the domain model is within reach of the average author. The introduction of modifications on presentation templates and rules can be an easy step for this kind of author towards a more advanced usage level.

At the time of this writing we are about to complete a set of interactive authoring tools to facilitate the construction of ontologies and domain object networks. Among our future work plans we include the development of a graphical editing tool where authors can customize presentation models by example, by editing generated HTML pages, as in (Castells 1999). The creation of this kind of tool is not possible without an explicit declarative model of presentation.

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Distance Learning Pedagogy: A Staff Development Series for Faculty

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Abstract:
Interest in distance learning is rising among students and professionals. The University of North Florida is preparing for students who expect technologically enhanced and delivered courses. While faculty and administrators at UNF recognize the need to offer online courses, they also recognize that the reputation of the university rests on its ability to continue to provide high quality student-centered courses. Using data that forecasts the growth in interest in online learning, and research on distance learning pedagogy, UNF has begun a program to guide faculty in effective online teaching. A series of workshops was offered to educate instructors university-wide on effective methods used in distance learning environments. The workshop series was called "Effective Teaching in Distance Education Classes." Topics were Team Building, Methods of Assessment, The Online Discussion Forum, and Distance Learning for Clinical/Internship Experiences. Workshops were structured as panel discussions with examples from various content areas and delivery platforms.

This paper focuses on an ongoing process of improvement of distance learning at the University of North Florida. UNF is a public, urban comprehensive university. The university has an enrollment of about 12000 graduate and undergraduate students in five colleges. Currently the university has hundreds of courses with on-line enhancement, and about 10 courses each semester are offered fully online. The university supports three web-based distance learning spaces beyond basic web pages: WebCT, BlackBoard, and Lotus Learning Space.

Interest in distance learning is on the rise among high school students, college students and professionals. A recent survey found that the majority of parents polled obtained Internet access for their children's education (Grunwald Associates 2000), and as of the year 2000 a full 15% of U.S. high schools offered access to online classes (Market Data Retrieval 2000). By the year 2002, over 2 million distance learning students are expected in higher education (Web-Based Education Commission 2000). The majority of working adults stated in a survey that they believe college courses offered via the Internet are the future of higher education, with 32% expressing a preference for online courses over classroom learning, given equal quality of education (CyberAtlas 2000). A survey of business managers who have used Internet-based training found that nearly 100% of respondents would recommend it, mainly because of anytime, anywhere access (CyberAtlas 2000).

Colleges and universities have begun to respond to the rapid increase in interest in distance education. In a recent survey by Framingham, MA based International Data Corporation (IDC 2000), the number of students expected to enroll in distance learning will increase by 33.1 percent annually, from 710,000 in 1998 to 2.23 million by 2002. IDC attributes this growth primarily to the use of the Internet. They see two-year colleges increasing their online offerings 85 percent by 2002, up from 58 percent in 1998; and four-year colleges are expected to increase online offerings 84 percent by 2002, up from 62 percent in 1998 (Boston Globe October 29, 2000). According to a recent EDUCAUSE e-mail survey of 464 high-ranking college information technology administrators, the greatest concern is distance education. Distance education enrollments will rise from 750,000 in 1998 to 2 million by 2002 with 6.6 million adults (age 25+) enrolling in education by 2007 (Katz 1999). More than half (55.5 percent) of the participants in the 2000 Campus Computing Survey report that their institution currently offers one or more full college courses online via the web, up from 46.5 percent last year (The 2000 National Survey of Information Technology in US Higher Education, http://www.campuscomputing.net/).

Public, private, and charter high schools offering online courses have also experienced recent popularity. During the 2000-2001 academic year Class.com offered 50 online courses to over 250 high school students (http://www.class.com). Over 3000 students attended Virtual High School (http://vhs.concord.org), and Florida

Online High School (http://www.fhs.net) enrolled 1000 students. Many other private and charter online high schools are attended by students who expect online courses in higher education. The net generation is completing high school and applying to college, and some of the nation's top high school students seek an institute of higher education that places priority on high quality web-based learning. Established colleges and universities compete for adult lifelong learners with the online schools offering a wide selection of courses in a convenient flexible timeframe.

Not only are more students entering college with distance learning experience and interest, they are also entering college with vast technology experience which alters their learning styles. Instructors face challenges when they work with classrooms of information age students who need to learn in ways that are new to many universities and instructors. Faculty need skills and tools for working with students on meaningful, authentic tasks, and in taking on the role of mentor, model, and guide. Information age students who have years of experience learning to use technology can assume more responsibility for their education. A college cannot address these challenges by applying computers to traditional education systems. To better serve students, classrooms need to adopt attributes of information-age workplaces: knowledge-orientation, flexibility, advanced skills, problem-solving, long-term projects, and communication of results. Distance learning features can be used in courses to empower students by encouraging students to pose and pursue questions while learning challenging and interesting skills, to expend long-term sustained effort for complex tasks, to learn in self-directed and exploratory ways, and to share results.

The University of North Florida is preparing for new and returning students who expect technologically enhanced and delivered courses as part of degree programs, certificate programs, or for career enhancement. At UNF, our mission is to educate students in a broad array of undergraduate and select graduate programs. Our dedication is to excellent teaching and scholarly activity and engagement of students in a personal, supportive and challenging learning environment. We seek to contribute to the betterment of society. Currently, new distance learning planning initiatives, predicated upon available technologies, commit the University to participate with local, regional and state organizations in serving as a clearinghouse for information concerning available instructional delivery options for students, employers, and residents of the community. In July, 2001, the city council of Jacksonville, home to UNF, declared that technology is the city's future," and that "technology is going to get us where we need to be" (Florida Times Union 2001). The council's report stresses the importance of education and area universities in helping the region achieve its goals.

While faculty and administrators at UNF recognize the need to offer online courses and course components, they also recognize that the reputation of the university rests on its ability to continue to provide high quality student-centered courses. Using data that forecasts the growth in interest in online learning, and research on distance learning pedagogy, UNF has begun a program to guide faculty in developing their practices in effective online teaching.

The university's Distance Learning Action Team was originally created as a temporary committee to advise the university on distance education, and to recommend policy. The action team is now a permanent subcommittee of the university's technology committee. Part of the role of the Distance Learning Action Team is to identify and support the needs of faculty as distance educators. During the 1999-2000 academic year, most faculty training in distance learning was skills-based and focused on using computers and specific course delivery technology. Workshops included setting up classes, putting tests online, managing online discussions, uploading documents in Blackboard, WebCT and Lotus Learning Space. During 2000-2001, such training continued, with an additional series focusing on the pedagogy and design for distance learning. A goal for the new workshops was to improve the quality of distance education throughout the five colleges, without using intimidating or specialized educational or distance learning vocabulary or jargon.

A series of workshops was offered to assist in educating instructors university-wide on effective methods used in distance learning situations. The workshop series was called "Effective Teaching in Distance Education Classes." The Distance Learning Action Team, working with the university's Office of Faculty Enhancement, sponsored the workshops, set up schedules and sent invitations. The Office of Faculty Enhancement is charged with providing the resources and the environment for the continuing professional development of UNF faculty. A group of experienced instructors of distance learning from several colleges worked with campus instructional technologists to determine workshop topics. A series of five workshops was developed and they were offered throughout the semester in a

digital conference room. An schedule of the workshop was disseminated throughout the university via web and e-mail. In addition to the published schedule, specific colleges were targeted with invitations, because of previous requests for assistance and instruction from those faculty. Each workshop lasted 90 minutes, with an hour for presentation and demonstration of skills, and 30 minutes of discussion with participants. Demonstrations included course syllabi, examples from current online courses, and samples of student work or student feedback about course experiences. Workshops were structured as panel discussions with demonstration of examples from various content areas and delivery platforms. Practices shared during the workshops were platform-independent, equally effective regardless of delivery system. An intended benefit of the workshop series was to provide participants with contacts who would be available for ongoing assistance. The target skills were appropriate for instructors teaching courses fully online, partially online, and enhanced with online components.

Workshop topics were Team Building, Methods of Assessment, The Online Discussion Forum, and Distance Learning for Clinical/Internship Experiences. An additional topic in development is the relationship between distance teaching and the university promotion and tenure process. A common theme throughout the series was planning for distance learning. Workshop facilitators stressed that expectations for student performance and participation must be determined beforehand, and must be communicated clearly to students at the outset of the class. All activities in the distance learning environment should be integrated into a cohesive learning process, interdependent instead of isolated. The workshop series also stressed variety of learning activities within an authentic context, as opposed to converting lectures and reading for the web. The skills and knowledge included in the most effective courses are relevant to students, either in their current lives or in their future roles. The skills and knowledge also represent the most desirable learning in the current state of the field of study (Cavanaugh 2001).

A faculty member from the College of Business Administration, where teaming is an important aspect of all courses, facilitated the Team Building session. The emphasis on team-building stems from educational research indicating that cooperative learning promotes high individual achievement. Distance education literature shows that course activities have the greatest value for students when they authentically approach the kinds of work students will experience beyond the course (Cavanaugh 2001). Students should work in cooperative groups or teams, to solve realistic problems. The instructor's role is to set up situations that approximate the professional world and require high levels of interdependence for success. Instructors must also model and require respect for student diversity and various learning styles. In the College of Business' online courses, class teams work together on projects and cases, simulating an authentic work situation. The distance learning environment includes virtual workspace where teams collaborate on drafts of assignments. Online personality inventories and learning style tests were used for student self-assessment, and the results were used to construct heterogeneous teams. Online discussions allowed team members to exchange personal stories, and to develop a collaborative team story including their goals and vision for the team. Teams developed their plan for communication and a code of conduct for team activities. Teams evaluated their performance as a group using rubrics using rubrics prepared by the instructor. The session facilitator demonstrated online examples from his classes to illustrate team-building methods, activities and goals. He also provided workshop participants access to his online teaching space and materials.

A faculty member from the College of Education led the session on Methods of Assessment. The underlying philosophy of this session was that the student-centered, project-based nature of distance education lends itself to assessment of student learning using a variety of methods. The session included demonstrations of a range of assessment techniques from the presenter's online courses. Tests and quizzes are available in most distance education environments, and offer advantages of automatic instant grading, providing students with immediate detailed feedback on short answer items. Open-ended questions may be administered in the online discussion forum, which can serve as a virtual blue book. Student participation in class discussions may be documented and used in assessment, and such assessment is streamlined using the tracking and archiving features of most distance learning delivery systems. Students may be interviewed about their progress via email. Electronic papers and projects may be submitted using email or course digital drop boxes. Instructors can use the word processor feature that tracks changes in documents to return comments to students. Student projects and presentations are most valuable when they can be shared class-wide within the distance learning course environment. An example is a student web page posted or linked in the student's or group's course web space. To give students a sense of control, instructors were encouraged to offer choices of activities and topics or they allow students to negotiate options. Control in distance learning often involves flexibility in scheduling activities and deadlines. Because students are more confident in the importance of their work when course criteria are stated clearly and are viewed as realistic, the session presenter recommended that all evaluation criteria for student performance be communicated at the outset of the course, and

suggested that posting rubrics for assignments is an effective method. Knowing the expectations up front places responsibility for learning on the student. The display of student abilities is the most important result of distance education. In the course of developing their abilities, successful students manage their learning by engaging in frequent self-assessment. Because self-assessment does not come naturally to all students, it is helpful when instructors guide and encourage students to assess themselves. Instruments such as rubrics, checklists, and journals are effective tools for helping students become independent and responsible learners. Such assessments provide information to students about their strengths and about the gaps in their knowledge. Students receive the greatest long-term benefit when they have extensive opportunities during a course to develop their skills in a realistic context, and assessment of skills should occur within that context (Cavanaugh 2001). The presenter provided participants with access to evaluation examples and rubrics.

Another faculty member from the College of Education led the session on the Online Discussion Forum. The session included discussion of the benefits and challenges of online discussions in courses, and examples of ways to include online discussions in courses. Because learning is an interactive activity and constructed socially, a key to success lies in communication between students and others. A quality benchmark is to involve students in communication during 50% of the time they spend on the course (Cavanaugh 2001). Frequent and active communication with the instructor, fellow students, or experts in the subject is essential in making students feel that they are part of the community of learners. Connection among students is vastly more motivating than isolation because students need to know that others care about them and that they are contributing to an educational endeavor larger than themselves. Valuable discussions may occur among students, instructors, subject matter experts, authors and professionals in the field. The presenter included tips for maximizing the effectiveness of online discussions, with numerous samples from current courses. This session emphasized careful planning to fully integrate online discussions with other course activities. Discussions open to all class members are appropriate for broad discussions, and other discussions may be limited to specific group members for team project work. Sample syllabi were presented to demonstrate ways to build online discussions into courses, and to help students to be accountable for the quality of their online contributions. Participants received lists of web resources, sample discussion topics, and sample student responses, along with student mention of online discussions in final course evaluations.

A faculty member from the College of Health presented the session on Distance Learning for Clinical/Internship Experiences. The presenter has used distance learning tools to connect students in the field with each other, with instructors and mentors, and with professionals. Students involved in field placements tend to feel isolated, and participation in a distance learning experience allows frequent sharing, feedback and questioning regarding the experience. The distance education course environment offers many tools for the clinical instructor: online discussions, digital drop box for field notes, email, shared workspace for projects, and automated testing. A valuable tool in the distance learning environment for clinical students is the adaptation of the discussion forum to serve as a personal journal. To use the discussion area in this way, a discussion topic or forum is created for each student, accessible by only the instructor and the individual student. Because students in clinical experiences are often located far from campus, contact between instructor and student is limited. The online journal allows frequent interaction. In a sense, this session brought together concepts from the previous sessions in a demonstration of a unique application of distance learning.

The session regarding the relationship between distance learning teaching and the promotion and tenure process was structured as an open forum between faculty and university administrators who understand and support distance education. In the traditional university system, promotion and tenure are based contributions in teaching, scholarship and service. Instructors have concerns about the ways online teaching will be evaluated, especially when an instructor's department chair may be unfamiliar with distance learning or opposed to distance learning. Instructors recognize that quality distance learning takes time, and they seek support from administrators ads they reach balance between time spent in distance teaching and time spent on research and publishing. At this workshop, university policies will be interpreted for distance faculty, and concerns raised about needs for new or adapted policy. The session will be moderated by the director of faculty enhancement, who also teaches in the College of Arts and Sciences.

The sessions were well attended and well received by participants, who represented colleges across campus. Participants included faculty who had already taught distance learning courses, those who had integrated distance learning enhancements into classroom courses, and those who were exploring distance education approaches for future courses. Most participants stated that they learned a great deal of information and strategies that they could

immediately put to use in their courses. The sponsoring groups are working on the schedule of sessions for the coming year. Previous sessions will likely be repeated, and will be augmented by sessions on new topics and continuations of previous topics. The series is seen as an ongoing faculty development initiative, organized in response to faculty needs.

An outgrowth of the faculty development series was a faculty distance learning handbook. The UNF Distance Learning Handbook was designed to provide UNF faculty and administration with information about the current state of the distance learning infrastructure at the University of North Florida. For faculty and administrators interested in developing distance learning courses and programs –particularly web-based – this handbook can serve as a guide in directing interested parties to the existing support services and resources [see Appendix 1 for the Table of Contents]. The handbook will be updated on a regular basis as new campus resources are developed and as more is learned about the potential for distance learning to advance the institutional priorities of the University of North Florida. The handbook was developed by working groups of the Distance Learning Action Team as a way to collect information presented at the faculty development series sessions, along with details about distance learning at the university. The handbook is printed on paper for faculty most comfortable with traditional media, and it is posted on the Office of Faculty Enhancement web site.

Appendix 1

UNF Distance Learning Handbook Table of Contents:

- UNF Distance Learning Policy Statement
- Scheduling and Registration FAQ
- Student Assessment of Online Courses
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- Pedagogical Resources For Online Instructors
    A. Principles Of Good Practice For Online Education
    B. Success Factors For Teaching Online Courses
    C. Preparing An Effective Online Course
- Sample letters to students

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Strategies for Assessing Student Writing in a Paperless Distance Learning Environment

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Today's distance learning environments can be a "paperless" environment for student research papers and projects. The "paperless" environment can offer advantages for students and teachers in the creation and assessment of work. This paper will describe practices that have been found to be effective, through action research with web based distance learning classes, on increasing the efficiency for the submission and evaluation processes for research papers and other student work within the "paperless" distance learning environment. These practices related to structuring evaluation and using rubrics, using screen readers, performing online research and referencing, using readability analyzers, word processing collaboration tools and options for submissions.

Web Page Evaluation for Education

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Abstract

Because the web is an important source of information in schools, teachers and students need skills for evaluating web sites. For a specific learning goal, thousands of web sites may exist, but not all of them will be appropriate. Web sites are written at a wide range of language levels, for a variety of purposes, and for diverse audiences. A great many web pages contain information that is not appropriate for student needs because of misinformation or bias. A critical eye is more important than ever. Just as students should be taught to critically evaluate print and broadcast information, they also need to learn to judge web information. A student should make judgments about a web page for its educational value. Students should make an assessment of its worth for the academic endeavor by judging the page's authority and currency, its publisher and purpose, and its objectivity and accuracy.

The use of web technology is already changing the world both beyond the school walls and within. The web can be a powerful tool for teachers and students, so opportunities for learning about its use should be a component of all instruction. It is important for all teachers to consider more than just the information presented on a web page. Usually web based information is developed for a specific purpose or with a specific goal. Some web pages were designed for educational use while others were designed for entertainment or business purposes. Teachers must be concerned with the abilities and developmental levels of the students who are using the web. This paper will present strategies and tools for teachers for assessing the appropriateness of web pages for student use. Additionally there will be strategies and tools for the students who are using the web for research.

The Need

Because of the ease of publishing on the web, Web page users do not have the checks and balances associated with traditional published material. When a web site is published, there is no guarantee that the pages have been checked for accuracy, content, or even spelling. Published web authors range from elementary school children to government agencies. The amount of the information available on the web has surpassed a billion unique pages and continues to grow by the minute, without a board or organization that indexes or controls what appears on the web. As the web continues to grow as a research and data tool, validation of web information will become even more important

A study on information literacy instruction in Tennessee, found that teachers' understanding about web based research was not associated with traditional library reference skills, and many teachers were either unfamiliar with information literacy or were under the misconception that it was the same as computer literacy. The teachers themselves were unable to describe their own process of selecting web resources and, when questioned about their students, the teachers stated that information literacy skills should be taught by the media specialist, who thought they were being taught by the computer teacher, who thought that they were being taught by the classroom teacher (Spearman 1999).

Evaluation of Web Sites by Students

In an evaluation the technology components within the Florida state curriculum standards (Sunshine State Standards) across the content areas, it was found that common themes and skills existed. The recurring technology themes and skills for students include effective information finding, evaluation of source information, and how to do research on the web. For a specific learning goal, thousands, if not millions, of web sites may be found, but not all of them will be appropriate. Web sites are written at a wide range of language levels, for a variety of purposes, and for diverse audiences. A great many web pages contain information that is not appropriate for student needs because the

pages contain misinformation or bias. Just as students should be taught to critically evaluate print and broadcast information, they also need to learn to judge web information. Students should be taught that the information that is presented on a web page should be judged based upon evaluative criteria. When a student is beginning a quest for information on the web, the answers to a few fundamental questions will help to guide them to useful and reliable information. A teacher can assist the process by providing the students with questions and checklists to assist students in their evaluative process.

Students should develop the habit of asking the following questions. "What kind of information am I looking for?" Decide whether news, opinions, multimedia files, historical documents, fiction, performances, databases, or other types of information best suit your need. "What do I want to use the information for?" Whether the information is for personal, professional, or classroom use determines how appropriate a Web page will be. "How extensively will I depend on the quality of the information?" When collecting information to present in a report or proposal, authoritative fact is much more important than when surveying viewpoints on an issue." How much information and detail do I need from the resource?" Many Web pages are primary source documents, while many others summarize those sources. Depth and comprehensiveness in coverage between sites varies greatly.

Students and teachers judging web pages for educational appropriateness should consider the following factors. Consider the authority of the writers, their background, their level of expertise, their knowledge of the topic. A good practice is to look for the "Last Updated" date to learn if the information is current. In many cases, it is not crucial that information be recent, such as when learning about consistent facts, grammar or vocabulary. At other times, the timeliness of the information is very important, such as when researching world events or political geography. The researcher should find out what group or individual is responsible for publishing the web page. The teacher or student should decide how the page's domain (.com, .edu, .net, .gov, .org, etc.) relates to the topic presented in the web page. It is always important to remember that information on an education server (.edu) is not necessarily from a reputable source: it could be written by a professor who is an expert on the topic, by a student of the topic, or by a student who has created a page for fun. If the material is published on a public server source such as AOL or GeoCities, the researcher should be aware that anyone who requests space can publish any information they desire with no checks on quality or accuracy of the information. Pages from a governmental agency or other professional organization generally have quality control measures. Everyone needs to follow the example of reporters and determine for himself or herself whether the source is reliable. The person researching must judge whether the information is objective or has a bias or slant. Notice whether the style of presentation is scholarly or logical. When an issue is presented, look for multiple viewpoints and determine if they are fairly represented. It is always important to determine the purpose of the site: to educate, to sell, to persuade, or to explain, and then to consider that purpose when reading a page.

Evaluation of Web Sites by Teachers

The resources gathered from the web can help educators make choices that are appropriate for their students. For many, safety is an all-encompassing concern when students are accessing the Internet. Other concerns include the quality, accuracy, and level of the information being made available. It is important to remember that web information changes constantly, so any evaluation of a Web page will characterize the page for that particular moment in time. It is a good practice for a teacher to always test the web pages against the desired learning goal. Using the Four A's for educational web page evaluation: Audience, Authority, Accuracy, and Appropriateness an instructor can develop guidelines for the inclusion of web material.

Teachers must also ensure that materials are appropriate for the special needs of their students, such as ESE or ESOL students. In addition to the guidelines above, there are considerations for using the web with students who have a disability or impairment (physical or cognitive) and students who are nonnative speakers of English. Perhaps the main thing to consider in Web site evaluation for ESOL students is the type of skills that the site builds in the students. These skills can include: Reading; Writing; Listening; Speaking; Grammar; Vocabulary, and Cultural Knowledge.

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Considerations and Suggestions as Using Blackboard to Teach and Learn

Introduction

Different instructional software is being employed in higher education to enhance and facilitate students' acquisition of knowledge. Learning with technology also promotes students' technology skills (Bazillion & Braun, 1998; Berger, 1998). Blackboard is one of the instructional applications, which allows learners and the instructor to log on whenever there is the accessibility of the Internet. Additionally, Blackboard enables learners and the instructor to teach and learn at anytime and anywhere with any means.

However, Blackboard does not guarantee the instructor to effectively administer an online course by simply filling up the pre-format template with the course content. Knowing how to mount a syllabus, homework assignments, reading requirements and/or quizzes does not ensure the instructor to hold meaningful and useful online teaching and derive desirable learning. Online education by no means includes posting syllabi, having students submit assignments, having students take online quizzes or providing online reading and homework assignments. ". . . putting up course notes and static, non-interactive course materials on the Web results in an effective virtual course—a virtual correspondence course, perhaps, but seldom a successful virtual learning experience" (Graves, 2000, p. 36).

To achieve effective learning results, it requires the instructor to motivate learners' desire to learn. With respect to infusion of technology into curriculum, the instructor preliminarily needs to build up an understanding of *meaningful* utilization of computer technology before carefully and holistically structuring a course design and strategies of its implementation (Chang, 1999). What and how an instructor performs will surely affect how pre-service teachers will manage their classroom instruction with technology in the future. Integration of technology with a little consideration and pedagogical meaning contributes only to superficial coverage of the course content and shallow exploration of learning. Facilitation of meaningful online learning calls for an instructor to implement reflection and self-analysis.

Theoretical Framework

It is a misconception that the instructor's responsibility is to prepare a course, deliver instruction, distribute assignments, and grade submissions, whereas the responsibility of a student is to attend classes, complete given assignments and submit required work. Nevertheless, "The professor, . . . is less the dispenser of knowledge and more the facilitator of it (Lambert, 2000). Teaching is, as a mater of fact, complex rather than linear. Students are pluralistic; each has unique experiences and knowledge" (Knowlton, Knowlton, & Davis, 2000, p. 54). The responsibility of an instructor is to understand how students learn, how to motivate students to learn and how to help students learn successfully (Edwards, 1993). The student's responsibility is to acquire knowledge that can be applied for problem solving and enhancing quality of education. True learning takes place as an individual learner interacts with the materials and is able to connect learned knowledge or skills with real practice (Katz, 1993).

Traditionally, students tend to forget about the content of delivered lectures after they leave the classroom (Bowers, 2001). Research has shown that technology benefits students' learning (Bazillion & Braun, 1998; Berger, 1998; Grossman, 1999; McCandless, 1998; Raschke, 1998). Bowers (2001) noted that the Internet enabled students to remember the delivered course content whenever they were (Bowers, 2001). Technology allows students to actively participate in content learning rather than to "enter courses as blank slates waiting to be filled with knowledge by the professor (Knowlton, et al., 2000). Learning via technology broadens the students' concepts, but also enhances their acquisition of learning skills, such as electronic learning skills that may be used in their future courses or later personal and professional growth (Bazillion & Braun, 1998). However, like classroom teaching and learning, instruction with technology factually imposes challenges to an instructor in respect of seeking ways to stimulate and provoke students' learning and thinking (Chang, 1999).

Considerations in Designing and Implementing an Online Course

I have taught students via the software of Blackboard in the past two semesters. In the Fall semester of 2000, there were 26 enrolled in Programs and Curriculum for Young Children. Twenty-eight students were enrolled in Nutrition and Health for Young Children. Of 26 enrolled students in Programs and Curriculum for Young Children, 23 were the elementary major of pre-kindergarten to 6th grade. Two students majored in Early Childhood Special Education with one having undeclared major. Of 28 students enrolled in Nutrition and Health for Young Children, 26 were the elementary major of pre-kindergarten to 6th grade. One was from Early Childhood Special Education with one undeclared major. In the Spring semester of 2001, I have 30 students in Programs and Curriculum for Young Children and 29 students in Nutrition and Health for Young Children. Of 30 students enrolled in Programs and Curriculum for Young Children, 26 were the elementary major of pre-kindergarten to 6th grade. Three from Early Childhood Special Education with a special student. Of 29 students enrolled in Programs and Curriculum for Young Children, 24 were the elementary major of pre-kindergarten to 6th grade. There are four from Early Childhood Special Education with one special student. Regardless of which major my students are undertaking, their future careers are associated with teaching and learning. As has been discussed earlier, influential modeling is of great importance. In the future, students may take on a similar mode as how they are instructed and taught previously. Additionally, for the best interest of their future children/students, meaningful and purposeful learning must be the center of attention of teacher preparation programs. In achieving this intention and taking advantage of online teaching and learning, I have been keeping field notes and other related notes in order to understand my teaching and understand how students learn. In so doing, I frequently analyze myself and solicit students' voices, based on which, I enter experimental strategies that allow shaping curriculum and employed instructional mechanisms to fit students' rights and needs while encouraging their ownership for learning. The followings provide my general understanding of what the instructor needs to carry out in designing a course via Blackboard:

(1) Acquiring necessary training for required technology: It is essential that the instructor find time to equip himself or herself with technology know-how before designing an online course.
(2) Practicing learned knowledge: Once technology is acquired, it does not mean that one is ensured to be able to manipulate given software. To enhance an understanding and familiarize oneself with learned technology know-how, the instructor is strongly recommended to take time experiencing the software.
(3) Focusing on the content of curriculum: As preparing a course design, the instructor needs to keep in mind learning goals and objectives of a course.
(4) Sketching a mental plan: Before sketching a written plan or laying out a written map, it is useful for the instructor to go through a mental map as to what are key points of a course and how this course is to be implemented.
(5) Sketching a written plan: With the formation of mental schema, the instructor may assume to process a written blueprint, which record vital learning elements and potentially employed strategies that facilitate students' meaningful and in-depth learning. In laying out this initial proposal, suggested effective learning opportunities may also be noted, which may embrace ways to encourage students' higher order of critical thinking, making connections and building relationships with their classmates through discussion, allowing reviewing one another's point of view, reflection of assigned texts, incorporation of the element of service learning experience.
(6) Refining the mapped-out design: The instructor refines the map and may consider webbing out the design.
(7) Designing meaningful and helpful assignments: Assignments are more than what is commonly understood as commodity exchanging for an instructor's lecture. It is a misinterpretation that to exit the study of a course, an assignment is a vital gatekeeper. Students attend classes for lectures and for doing assignments. In fact, submitted work from students serves as a vehicle for widening their views and for augmenting their understandings of learning content. Furthermore, required work serves the purpose of exchanging understandings and ideas among students. Assignments also can be conceived as a learning opportunity for students and the instructor, through which they are able to teach one another by providing constructive comments and recommended ideas. Moreover, assignments help

the instructor to discern how students have learned and what teaching approaches work and what requires further refinement and improvement.

(8) Considering ways to make maximal personal immediacy: Online learning deprives students and the instructor of frequent personal touches or frequent face-to-face on campus meetings that a traditional classroom usually possesses. Acknowledging the drawback, the instructor takes into account elements as he or she designs a course. The instructor contemplates of how to maximize personal immediacy. This may be accomplished by replying students' email messages, including requests, questions, and concerns and by providing immediate feedback to students followed by their online submissions.

(9) Being willing to accept challenges from students: In the process of web-based education, it is beneficial that the instructor sincerely listens to students' voices, accept students' constructive suggestions and input, which are helpful for improving the virtual classroom teaching and learning.

(10) Finding ways to deal with difficulties: Teaching and learning online is not something that has been in existence for a long time. A plethora of research studies are undertaking to discover more and more valuable understandings of effectiveness with regard to online teaching and learning. Many questions are to be answered. Given the current situation, difficulties are, therefore, predicable. The instructor needs to patiently and bravely take time to probe into emergent problems and seek as much advice from others as possible for resolutions of barriers.

(11) Finding ways to handle frustrations: Associated with unsolved difficulties, the instructor may feel frustrated and disappointed. However, writing notes and clearing ones' thoughts are essential to conquering a difficult moment. Seeking support from technological personnel or from those who have had prior experiences in online teaching may help overcome difficulties.

(12) Obtaining administrative support: Fighting alone may add to a level of frustration. Searching for administrative back up is of necessity. One's frustration may stem from limited capacity of technology equipment. In this sense, one may easily defeat the difficulty by enhancing the understanding of the administrator and by replacing the old machine with an updated one.

(13) Keeping working relationships with technology personnel: Technology know-how is soaring day by day. An instructor may encounter a series of questions that a workshop may not fully offer. Thus, technology personnel need to be contacted and consulted with.

(14) Managing time: Designing an online course is by no means easy and may eat up more time than one may anticipate. Organizing one's time is of priority. Too much time contributed to the online design may interfere with other obligations.

(15) Making online courses manageable: What to include and what to put aside need to be taken into serious consideration. The instructor has to make such teaching manageable to balance between work and personal life.

(16) Communicating with colleagues and administrators: It is essential and vital to make your initiative known to your colleagues and administrators at annual reappointment, and other relevant promotion meetings. This novice teaching and learning experience needs to be understood due to the fact that much research and trial and errors are involved. Time is devoted. Be realistic, honest and detailed.

Suggestions for an Online Design and Implementation

(1) Taking in a little at a time: Learn and practice technology know-how little by little. Don't be greedy or anxious, wishing that you would grasp all required technology skills overnight.

(2) Giving clear instructions with respect to the instructional software: Figuring out a way to help students understand the employed software. Frustration and fear can be roadblocks for students' continual learning desire. It may be a good idea that a written guidance for walking students through a web-based course can be concurrently offered with personal instruction at the first class meeting.

(3) Making clear of course expectations: Use a simple and jargon free language as the instructor elaborates the course expectation, having students prepared at the beginning of a semester.

(4) Repeating yourself whenever it is necessary: In the process of teaching and learning, grabbing an appropriate opportunity to go over what has been announced and distributed.

Sometimes, students need more than once to comprehend instruction or expected learning assignments. At times, a student's question may be considered representative of the whole class' puzzlement.

(5) Balancing your workload: Although more is better, helping students construct an understanding of the course content needs balance. Too much requirements may exhaust the instructor as well as students. A good intention may turn out to be "an evil ending."

(6) Balancing work with one's personal and family life: It is known that online teaching requires extra work and time. After all, one's personal life and significant others should also be within the arms' reach of the instructor, deserving his or her attention.

(7) Keeping in mind: Nobody triumphs his or her success with only one attempt. It is well recommended to keep trial and error since failure is the mother of success.

(8) Understanding students: Keeping in mind that students have different expectations and references. It may be a good idea to combine novel and traditional ways of teaching to accommodate different learning methods.

(9) Making commitment: Having said that online teaching requires time and extra efforts, committing to such work is critical because such teaching and learning is time consuming and may not end in expected outcomes.

(10) Soliciting students' feedback with a variety of ways: It is useful to attain students' voices and feelings toward online teaching and learning. It may be considered to obtain these by pre- and post-surveys, oral requests, and group meetings. These needs fit for a wide array of students and allow you to acquire comprehensive feedback. These methods are sensitive to students' needs and are appreciated by the students. The feedback is useful for improving online courses and does away with teaching a same course with the same set of strategies over and over regardless of needs and rights of students from year to year.

Conclusion and Implication

Teaching and learning online is the future and is not at all an easy task to implement. Thinking, designing, reflection and analysis through online classroom research are fundamental to effective instruction and improving the quality of teaching and learning. This leads to a lot of thinking and work, which calls for commitment, dedication and devotion. Balancing weight in teaching and life outside teaching is of primary importance. Researched teaching strategies applied to online learning and teaching result in merits to students' confidence in learning, students' enhancement of technology skills, reflective thinking of students and an instructor, learning from one another, promoting relationship between the teacher and students, provoking students' consideration of how they will infuse technology into their teaching and learning, controlling their learning, active learning mode, establishing ownership, promoting a productive learning community, and being willing to explore more. And yet, many studies are in demand for understanding how to make the most of online teaching and learning (Boettcher, 2001). In general, a lot of research is needed for an understanding of how to promote quality online teaching and learning.

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Learning Style Differences and Attitudes Toward Web-Based Distance Learning among Pre-service Teacher Education Students

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Abstract: Web-based courses with distance learning components have become popular in teacher education programs and there is every indication that the trend will continue. This paper is a brief report on the findings of a study conducted on pre-service teacher education students' learning style, attitudes toward web-based distance learning and the relationship between attitudes and learning styles in this learning environment. Kolb's experiential learning theory, Moore's theory of transactional distance and related learning theories are synthesized as a framework to investigate research inquiries. This study established a basis for better understanding theories and practices in distance education as well as pre-service teacher education student learning in web-based environments.

Introduction

Distance learning technologies are playing an important role in teacher education programs throughout the world. Web-based distance learning has greatly helped connect pre-service teachers and their college supervisors, sometimes separated by space and/or time. Distance learning also allows pre-service teachers at distant sites to network and plan cooperative activities. Literature revealed that the understanding of learners' factors, such as learning styles and attitudes toward distance education was widely considered to be important for designing and implementing distance education (Martin, & Rainey, 1993; Moore & Thompson, 1990; Starr, 1993). Despite the widespread adoption of web-based distance education technologies in teacher education programs, we know very little about pre-service teacher education students' attitude toward web-based distance learning and whether differences in learning style, if any, would influence their attitudes toward this new learning environment. Understanding the relationships between learning styles and attitudes toward web-based distance education among pre-service teachers would help us target initiative/intervention/design efforts more effectively.

The main purpose of this study was to determine if there is a difference in teacher education students' attitudes toward web-based distance learning based on learning styles. Additionally, individual learning styles of pre-service teacher education students and their attitudes toward web-based distance education were also investigated.

Method

The participants for this study were elementary teacher education students (pre-service teachers) who enrolled web-based courses that have a face to face and a distance component to the course at an eastern University in the U.S. in Spring 2001 (169 students totally). Two self-assessment instruments were employed to collect data. Kolb's Learning Style Inventory (LSI) (Kolb, 1985) based on Kolb's (1984) experiential learning theory was used to determined the participants' preferred learning styles as one of the following four types: Converger, Diverger, Accommodator, or Assimilator. *Web-Based Distance Education Attitude Instrument*, based on Moore's theory of transactional distance (Moore, 1993) and associated adult learning and distance education theories, developed by the researcher was applied to understand study participants' attitudes toward the web-based distance education in terms of teaching and learning. In addition, written responses on participants' evaluation of web-based technology as a course delivery method, and personal information, such as age, gender, student status (full-time vs. part-time), prior computer experience and Internet use, were also collected.

Results

For the learning style profile of respondents, 63 out of 157, or approximately 40.1% of study participants in this investigation were assimilators; 48 (30.6%) were divergers; 25 (15.9%) were convergers; and 21 (13.4%) were accommodators.

For the attitude survey, factor analysis using the principal components method with orthogonal rotation extracted three uncorrelated factors (Interaction, Effectiveness, Barriers) which accounted for 46% of the variance in student self-reported attitudes. Additionally, the mean and standard deviation scores, as well as score ranges of all attitudinal statements were calculated to understand study participants' attitudes toward web-based distance education based on the four types of learning styles. Results indicated that overall there was a positive attitude toward the web-based distance education among learners participating in the study.

Furthermore, an overall MANOVA and three individual ANOVA for the three attitudes scales were performed and the results indicated that in this study, there was no significant difference in elementary pre-service teacher education students' attitudes toward web-based learning for various learning style groups (F-Interaction (3, 154)=1.67, $p>.05$; F-Effectiveness (3, 154)=0.45, $p>.05$; F-Barriers(3, 154)=1.42, $p>.05$; p-value of Wilk's Lambda was .34).

Conclusions

This investigation found that among four types of learning styles as assessed by LSI, participating students with the Assimilator learning style were the biggest group in the study, followed by those having the Diverger, Converger, and Accommodator learning style. About one-thirds of study participants were more likely to focus on ideas and abstract concepts and less on the practical values developed as assimilators. In addition, based on the distribution of four types of learning styles, it is clear that individual differences exist among teacher education students who participated in the web-based learning setting in this study. The importance of sound instructional design that considers different learning styles as a key design element is supported.

Results of this study revealed an overall positive attitude toward web-based distance education among elementary pre-service teacher education students participating in this investigation regardless of learning style. Furthermore, the differences in students' learning styles did not have any effect on students' attitude toward web-based distance learning. These findings were consistent with other learning style-attitude research in the field of distance learning research, although emphasizing different age groups and conducted in different context of distance education (Chen, 1999; Gee, 1990; Starr, 1993). Web-based distance learning serves as a self-directed learning context with which pre-service teachers can self-pace their learning and also interact with educators, peers, and learning resources, which may in turn facilitates them in developing life-long learning skills.

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An Investigation of University Teacher Education Students' Internet Use and Perceptions in Web-Based Instruction Learning Environments: A Case of Taiwan

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Abstract: This paper is a brief report on the findings of a study conducted on teacher education students' use of Internet in learning processes and their involvement in web-based instruction in Taiwan. Both quantitative and qualitative approaches to research were employed. Findings indicated that most students expressed positive responses toward web-based instruction especially it supports active learning. Students also expressed various concerns, expectations and barriers while participating in web-based instruction and different needs for instruction and training to effectively participate in web-based learning environments. Educators need to constant reflect on their pedagogical beliefs and practices in technology-supported classrooms and take a wary approach to implementing web-based instruction that better taps its potential for student-centered learning.

Introduction

The World Wide Web (WWW) has become a useful educational medium and provides new learning environments and experiences for students that were not previously possible. Web-based instruction (WBI) is defined as an innovative approach for delivering instruction to a remote audience using the World Wide Web as the instructional delivery system (Khan, 1997). WBI has been used not only in fully distance education programs but also in supporting face-to-face traditional classroom instruction (Cornell, 1998). In this study, major learning theories, including self-directed learning (Candy, 1991), constructivist learning (Duffy & Jonassen, 1991) and the social aspect of cognitive development (Vygotsky, 1978), collaborative learning (Bruffee, 1993), resource-based learning (Rakes, 1996), and the theory of diffusion of innovations (Rogers, 1995) are synthesized into the theoretical framework that gives a special focus in understanding teacher education students' use of the Internet and their learning in web-based instruction.

Method

The purpose of this study is twofold. First, it intends to describe the level of Internet use as a new learning tool and as a resource by university teacher education students in Taiwan, and various aspects of Internet use in Web-based instruction in which they have participated, along with their perceptions of the benefits and barriers of web-based learning environments and such Internet use. Second, it aims to examine the relationship between students' level of Internet use in their studies and selected variables.

Participants in this study were students who enrolled in the teacher education programs at two four-year, degree-granting universities in Taiwan. This study employed both quantitative and qualitative approaches to research. Two sources of data collection were used. A survey of 63 questions containing 141 specific items developed by the researcher was used to collect both quantitative and qualitative data. A semi-structured interview protocol including ten questions designed by the researcher was used to collect qualitative data through in-depth interviews with a purposeful sample (Guba & Lincoln, 1989) of participants. Descriptive statistics, factor analysis, multiple regression, and qualitative analysis including sorted, and coded themes were

employed. The follow-up qualitative analyses of this study were used to help expand, interpret and analyze the quantitative findings. In addition, the qualitative results also provide methodological triangulation for this study.

Results

Results indicated that the majority expressed positive responses toward web-based instruction in many aspects. A variety of instructional materials were available online for students' use in web-based instruction that had different instructional objectives. Technical problems (Internet traffic congestion, server down-time, and short of technical support) and personal constraints (lack of adequate knowledge or skills to use the Internet effectively for communications and online search) were the greatest barriers that students have encountered while using the Internet in web-based instruction courses. Additionally, individualistic learning approach, as opposed to social learning approach or collaborative learning, was more or less dominant when the Internet was used in web-based instruction, despite the fact that students seemed to be aware of the advantage of involving in social learning opportunities supported by networked learning environment. Findings suggested that students' overall level of using the Internet in learning was not widespread. However, they expressed expectations of involving in web-based instruction more widely in supporting learning.

Furthermore, results showed that four variables – Internet literacy, perceptions of the Internet as an innovation, access to the Internet, and perception of learner autonomy, when combined together – explained 45.8% of the variance in students' self-directed/initiated Internet use in their learning processes. Among these factors, Internet literacy was the best predictor of students' Internet use level. Gender and age did not contribute statistically to students' Internet use.

Conclusions

Students generally expressed positive responses toward web-based instruction. Although a few students' perceived benefits of the Internet use in learning processes were limited primarily to convenience, many students seem to be aware that the potential of web-based learning environment for changing the way in which they learn. Evidence from students' survey, written comments and interviews shows that web-based instruction is a powerful way of learning and instruction in terms of supporting active learning. Despite recognizing benefits, students sensed the continuing need for the human touch in teaching and learning.

This study suggests that the teacher's role in a technology-supported classroom is critically important. Students' use of the Internet in web-based instruction courses would largely depend on faculty members' constant reflection on their beliefs and practices to better support students with opportunities to collaborate with their peers and to learn together. Also, when teachers in Taiwan are able to change their beliefs about the nature of education, new technologies can be implemented in ways that better tap their potential for aiding student-centered learning.

Multiple literacies and various literacy instruction, such as computer and Internet literacy, information literacy skills, computer-mediated communication, English language literacy, multimedia presentation, using online search engines to conduct research, self-directed learning etc., are needed for students to use the Internet effectively and thus participate in the information society and communication age.

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Developing Java Servlets for Web Based Teaching

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The paper considers issues of Java Servelet technology and its application in Web based teaching. It discusses the usefulness of Java Servelets in business and in teaching. The discussion on the implementation of a Java Servelet with Java programming language is also given. The ease of learning Java, its reliability, and its portability make this programming language a convenient tool to implement a Java Servelet. As an assistant in classroom teaching, Java Servelets have the flexibility needed to develop classroom demonstrations and Internet enabled client-server applications. The objective of this paper is to discuss the implementation of Java Servelets in classroom teaching.

The Clipper Project: Designing Effective Web-based Courses for Pre-Baccalaureate Students

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The Clipper Project is a research endeavor designed to study the effects of Web-based learning on pre-college students. Using Blackboard's CourseInfo Lehigh University currently offers two online courses for students accepted early decision, calculus and economics. The professors partner with an Information Technologies consultant to incorporate technological tools into their courses that are not readily available in traditional classroom setting. The Clipper Project is a constructive step towards effective Web-based instruction that will lead to a positive learning experience for students and faculty alike.

From educational multimedia to "global digital library" development: Convergence of technology, content, and international collaboration

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Abstract: Multimedia technology has shown its promises for educational applications at all levels of academic institutions as well as business settings for sometime, long before the Internet and World Wide Web have become commonplace. Then, in recent years, particularly the last half decade, we have witnessed how the Internet has changed our world in every conceivable aspect -- everything from how we communicate, learn, conduct research, deal with information, do business, receive health care, and dealing with our governments at all levels. Thus, desktop education has been extended to networked-based learning and education.

As to information provision, academic institutions have long been advocating the importance of their libraries and library collections. The old model is "the larger the collection and the closer it is to the users the better." But now in the Internet era, this powerful global information network has provided the kind of infrastructure and environment natural for international collaboration if only the desired information resources are "digital." Thus, the new emphases have shifted from "owning" to "sharing," from "physical libraries" to "virtual libraries," from one central library with huge collections to the federated distributed digital library systems all over the world... With the exciting convergence of technology, content, and global collaboration, we can visualize the coming of a kind of "global digital library" unattainable in non-networked environment.

In this paper, the author will share some of her own experiences in all these areas and transformations -- from the creation of the award-winning interactive videodisc and multimedia CD-ROM, called *The First Emperor of China*, in mid- and late-1980s, to her current international digital library project, called *Chinese Memory Net*, supported by the US National Science Foundation, as well as the latest China-US Million Book Digital Library Project.

Introduction

Long before the Internet and World Wide Web (WWW), multimedia technology has already been effectively utilized to develop powerful educational applications at many levels of educational institutions as well as in business settings. As the Internet and WWW proliferate to such an extend, they have truly changed the way we communicate, teach, learn, conduct research, do business, deal with government, etc. The fast- and broadband global network provides a kind of environment natural for globally collaborative learning and research. Thus, much of the existing multimedia applications have also been transformed mostly for network-based learning.

With the proliferation of digital information resources on the web as well as the growing popularity in creating digital information, as well as in converting print and non-print resources to the "digital" ones, we have sensed the fast growing interests in developing "digital libraries," "virtual libraries," and the like everywhere.

In the following few pages, this author was asked to briefly discuss these developments and transformations as they relate to her own experiences. Her projects will be used to demonstrate this exciting time when technology, content, and international collaboration are truly converging to enable us to provide access to needed human knowledge in such a way far beyond our imagination even just a couple years ago.

Vision for Universal Information Access

Prior to this digital age, the model for better information provision and services is to create larger collections at its own sites. This is why academic institutions value the large number of books and journals available in their own

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libraries. But now in the Internet era, this powerful global information network has provided the kind of infrastructure and environment natural for international collaboration if only the desired information resources are "digital." Thus, the new emphases have shifted from "owning" to "sharing," from "physical libraries" to "virtual libraries," from one central library with huge collections to the federated distributed digital library systems all over the world...

This is the time we can begin to entertain a bold vision for universally accessible collections of human knowledge as advanced by the President's Information Technology Advisory Committee's (PITAC's) Panel on Digital Libraries (February 2001):

> *"All citizens anywhere anytime can use any Internet-connected digital device to search all of human knowledge. Via the Internet, they can access knowledge in digital collections created by traditional libraries, museums, archives, universities, government agencies, specialized organizations, and even individuals around the world. These new libraries offer digital versions of traditional library, museum, and archive holdings, including text, documents, video sound, and images. But they also provide powerful new technological capabilities that enable users to refine their inquiries, analyze the results, and change the form of the information to interact with it...*
>
> *"Very-high-speed networks enable groups of digital library users to work collaboratively, communicate with each other about their findings, and use simulation environments, remote scientific instruments, and streaming audio and video. No matter where the digital information resides physically, sophisticated search software can find it and present it to the user. In this vision, no classroom, group, or person is ever isolated from the world's greatest knowledge resources."*

The Convergence of Technology, Content, and Collaboration

"Anytime, anywhere, on any device" stands strong this year as many groups' most-quoted slogan, including those of the digital libraries and networks, as well as those in commerce. Sure, this ambitious and crafty near-alliteration can only become a phrase of reality with the continued developments in pervasive computing. These include not only very-high-speed networks, but also the wireless ones. In fact, when we say "any internet-connected digital device" and "anywhere," we are or will be definitely pointing to the wireless device. Wireless LANs are maturing, offering faster speeds and interoperability with a multitude of devices. From the technology side, it seems easy to see what we need and where we are going.

But, the real challenge is not relating to "technology." When we are referring to "all of human knowledge," we are surely pointing to the enormously huge "digital contents," much more so than any current data centers, or digital libraries can possibly begin to offer. While technology is maturing rather quickly, the bigger challenge is the creation of the large quantity of high-quality digital contents. Take libraries as examples, this is why we are seeing all kind of digital library initiatives ranging from the digitization of specific collections of invaluable resources to elaborate regional, state, national, or international collaborate efforts devoted to creating digital contents, developing innovative technological tools, and introducing exciting new ways of information retrieval and service provision. Similar activities are going on in the museum and archival worlds globally.

In order to create high-quality digital contents, we need to carefully select the potential candidates for digitization. Then, we need to have proper technological tools to design, manage, preserve, and retrieve the digital contents. Yet, no one institution can possibly possess all the valuable contents of a given topic, thus, collaboration becomes essential. While in old days, and even now in its traditional ways, libraries learn to cooperate via "interlibrary loan" to share their resources. In this current digital age with its high-speed networks, it becomes a reality for institutions or individuals to collaborate regardless the distance between them. In fact, one can collaborate just as easily with collaborators in the other side of the globe as those next door to his/her office.

With this kind of exciting convergence of technology, content, and global collaboration, we can visualize the coming of a kind of "global digital library" positively unattainable in non-networked environment.

From Multimedia to Collaborative Global Digital Library Development

In the last 15 years, this author has engaged herself in a few major federally supported research and development projects. The experience gained through this exciting journey from multimedia to collaborative global

digital library development will be briefly described in the following while more detailed information on the current *Chinese Memory Net (CMNet)* can be found in Chen (2001):

Educational Multimedia and *The First Emperor of China*

In 1984, when the Internet was still unknown to most people, and CD-ROM was not yet introduced to libraries, because of the high cost, with the help of industry such as SONY, the Library of Congress was probably the only library in the US could have videodisc technology applications. Recognizing then the potentials of the interactive videodisc technologies, I embarked on a major project, PROJECT EMPEROR-I, supported by the US National Endowment for the Humanities. This project demonstrated that this interactive videodisc technology could indeed help to overcome the barriers of time and distance by enabling educators, researchers, students, as well as the general public to gain multimedia access to The First Emperor of China's fascinating 7,000 terracotta figures of warriors and horses. In early 1990s, the project effort was expanded to use cutting-edge multimedia technology. As a result, the Voyager Company published two award-winning products (interactive videodisc and multimedia CD-ROM) in 1991 and 1993 respectively (http://voyager.learntech.com).

With numerous user-friendly multimedia courseware that provide flexibly links to needed texts, audios, still images, and videos (sample demonstration will be made during presentation, see also Figure 1 for the Table of Contents screen, and Figure 2 for sample screens); as well as interviews, the products have been widely used in various educational settings as well as by general public. As shown in Figure 1, the features include:

- Textual commentary from experts in the field of Chinese history and archaeology
- Bilingual English/Chinese soundtrack
- Dazzling photography of hundreds of life-size terra cotta warriors and horses
- Original film footage of the excavation in QuickTime video
- An "Image Index" with essays linked to photographs
- A thumbnail index to all photographs
- Reference tools, including maps, a timeline, an extensive bibliography, and a glossary with Chinese characters and audio of Chinese pronunciation

The products also received many honors and awards. Although well received by their users, they are created for use with desktop computer facilities only, and cannot be shared over the network. The interactive videodisc is an analog product, while the multimedia CD is not web-compatible.

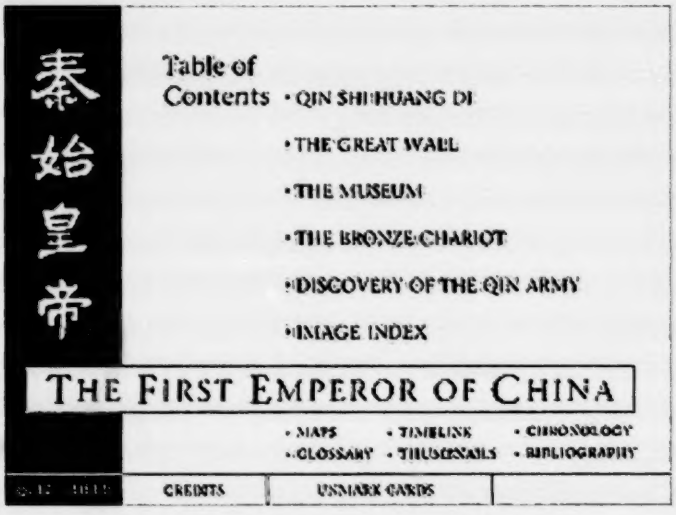

Figure 1: "Table of Contents" screen of *The First Emperor of China*'s multimedia CD

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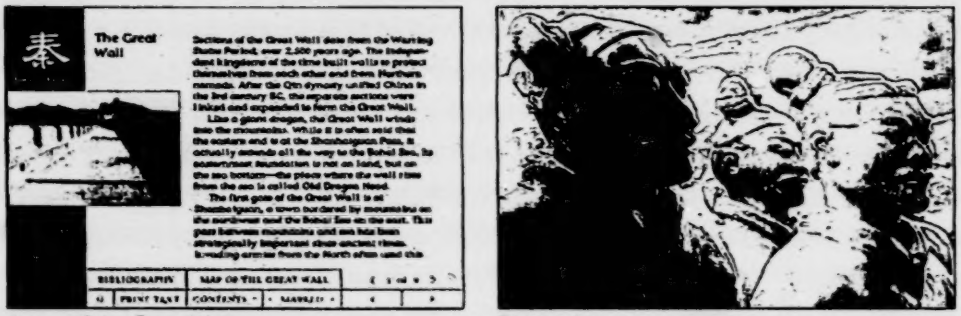

Figure 2: Sample screens from *The First Emperor of China*'s multimedia CD

With the advent of communications and information technologies in the early 1990s, and the anticipation of the coming of the Internet, it became clear to me that in order to promote better information sharing in the coming "digital" age, there is a real need to work toward a "digital knowledge base." Again, *The First Emperor of China was* a perfect example used to prepare several feature articles including that in the 1994 issue of IBM's *Multimedia Today* (Figure 3) (Chen, 1994) to advocate such a concept.

Figure 3: Images of the first two-pages of the featured article on "digital knowledge base"

The power of current technology supports sophisticated systems for connecting people to all kinds of old and new forms of knowledge. It also links between the expanding physical and intellectual universes. Thus, looking at a traditional library, for example, throughout history, its mission is to facilitate the free flow of information. While this mission remains unchanged, yet the ways in which information and knowledge workers (including librarians) used to fulfill this mission is constantly changing due to the advent of technology. In other words, the tools they use to create, collect, transmit and preserve recorded information sources, and the ways they organize, store, retrieve and use all types of available information have changed. The coming of digital knowledge age has profound impact on the kind of information services available for people and institutions.

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Hypermedia on Learning: A Literature Review

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Abstract: This article reviewed the literature from hypermedia research. Several perceived problems are identified, which include: (1) irrelevant assessment of outcome variables, (2) weak methodological design in conducting experimental research, (3) lack of theoretical foundations in designing hypertext systems, (4) lack of specification of precise learning outcomes and (5) lack of learner's prior knowledge in the content area. Furthermore, suggestions are made to reform the future hypermedia research agenda. The suggestions include: (1) future research should focus on assessing relevant student's learning outcomes (knowledge acquisition, knowledge integration and knowledge generation), (2) researchers should develop reliable and valid instruments and methodology of experimental design (reporting reliability of criterion measures), (3) hypermedia design should reflect hypotheses derived from established learning and instructional design theories, and (4) future studies should consider learner's prior knowledge and varied learning styles.

Introduction

Hypermedia learning environments are currently being employed as major components for designing and implementing educational and training learning environments. This fact can be validated by the increasing number of online courseware in school settings and corporate environments as well as by the number of articles and journals in hypertext-related literature.

Several theorists and researchers in the field of instructional technology have made strong arguments for integrating hypermedia technologies into educational and training environments. They have argued that hypertext structures match with human mind's cognitive structure, and that this congruence can facilitate learning. For examples, Kearsley (1988) has indicated that "hypertext matches human cognition; in particular, the organization of memory as a semantic network in which concepts are linked together by association" (p.23). Jonassen (1993) clarified Kearsley's statement by indicating that "hypertext provides an electronic environment to facilitate knowledge exploration via links created by the course experts. Because hypertext is a node-link system based upon semantic structures [as opposed to a sequential access system], hypermedia can map fairly directly the structure of knowledge it is presenting" (p.14). Based on these two statements, it would seem that hypermedia, properly conceptualized and implemented, would be a very effective instructional tool for facilitating

learning.

However, in reviewing the existing research of hypermedia on learning, the results are quite disappointing (Astleitner & Leuner, 1995; Tergan, 1997). Specifically, there is little empirical evidence showing that a hypermedia learning environments improve learning outcomes (See Beeman et al., 1987; Gordon & Lewis, 1992; Hammondm & Allinson, 1989; Jonassen, 1993; Jones, 1989; Marchionini, 1990; Marchionini & Shneiderman, 1988; van Den Berg & Watt, 1991). Additionally, it is still questionable as to whether hypermedia learning environments can be designed to be effective and efficient learning environments for different kinds of learning objectives (Astleitner & Leuner, 1995; Balcytiene, 1999; Spiro & Jehng, 1990; Tergan, 1997). The purpose of this paper was to review the existing literature related to hypermedia learning environments and to point out some of the inadequacies that may be limiting its potential usefulness in facilitating student learning. As a result of this review of the literature, suggestions for future research in the field of learning with hypermedia are provided. The ultimate goal of this article was to examine the research base in hypermedia on learning in order to identify existing limitation inherent in existing research and to provide a research agenda, the results of which would assist instructional designers in producing appropriate instructional materials to facilitate student achievement of the varied levels of performance outcomes.

Problems Associated with Learning with Hypermedia

Astleitner and Leutner (1995, p.389) have identified three basic problems on learning with hypermedia. They are:

- Goal attainment: which comes from distraction caused by the huge amount of information in a hypermedia system. Under this circumstance, students will miss the most important information and spend too much time on browsing unnecessary information.
- Spatial disorientation: which comes from the complex node-link structure of hypermedia. Students do not know where they actually are, where they come from and where they should go next. This is the famous so called lost-in-hyperspace problem when they learn in a hypermedia environment.
- Knowledge acquisition: which comes from learner's cognitive overload when they confronted with a high memory demand.

While the first two problems deal with the information retrieval process, it has little to do with learning. The third problem related to human information acquisition process related to the learner's cognitive overload when they are confronted with a high memory demand guides the literature review of this article. This contention is supported by Whalley's statement, claiming that "the concerns of the developers of hypertext systems have always primarily focused on information retrieval rather than learning" (1993, p.8).

By reviewing the existing literature of hypermedia on hypermedia learning, several potential problems are summarized as follows:

- Assessment of irrelevant outcome variables: The majority of the hypertext research focuses on the navigational behaviors on information retrieval instead of evaluating learning performances as the related to different types of learning objectives (See McKnight et al., 1990; Schroeder & Grabowski, 1995; Senn & Horton, 1996; Simpson & McKnight, 1990).
- Weak methodological design in conducting experimental research: Astleitner and Leutner (1995) observed that research in the field of learning with hypermedia is still dominated by computer scientists by charging that they "do not dispose of that high-quality methodological repertoire concerning empirical investigation which is usually common to social scientists. Often studies are based on weak designs with only few persons and without experimental control" (p.395). Similarly, Tergan (1997) contends that the major problem in the hypermedia research over the past ten years was that it was too technologically oriented and not so well grounded in the knowledge of applied cognitive science.
- Lack of theoretical foundations in designing hypertext systems: Many of the current hypertext applications are designed with no instructional theoretical foundations, emphasizing technical features or simply designing by intuition (Astleitner & Leuner, 1995; Balcytiene, 1999; Spiro & Jehng,

1990; Tergan, 1997).

- Lack of attention to learner prerequisites: Learner's prerequisites (prior knowledge, aptitude, reading comprehension, etc.) have been established to be a critical learning variable that influences hypertext learning. However, most empirical studies on learning with hypermedia do not take into account individual differences and learning styles. Researchers fail to consider that "novice learners are not typically familiar with the procedures associated with constructive self-regulative learning" (Tergan, 1997, pp. 227-228).

Future Research Agenda

In acknowledging many of the problems associated with the hypermedia research reviewed, several suggestions are made to guide future research in the field of learning with hypermedia.

- Future research should focus on assessing relevant student's learning outcomes that would include facts, concepts, abilities of comprehension, problem solving skills and other higher critical thinking skills. Student's authentic learning capabilities cannot be completely understood by simply looking at their browsing behaviors, such as numbers of mouse clicks or time spent on a single hypermedia page.
- Different types of hypermedia routines need to be examined in terms of their differential effects in facilitating achievement of different types of educational objectives.
- Hypermedia routines need to be examined in terms of their ability to create learning environments conducing to facilitating achievement in terms of knowledge acquisition, knowledge integration and knowledge generation.
- To overcome the methodological drawbacks, researchers should develop reliable and valid instruments for measuring student's performances in hypermedia learning. More importantly, the studies should be conducted in experimental settings with cognitive psychological background and also grounded in existing research base. Reliabilities of all dependent measures should be reported.
- For hypermedia courseware designers, the design should be based upon instructional theories. For examples, elaboration theory developed by Reigeluth and his associates (1978) helps select, sequence, summary and synthesize course contents, which can serve as a good design model for organizing hypermedia materials (Chou, 1999; Hoffman, 1997); cognitive flexibility theory developed by Spiro and his colleagues (Spiro et al., 1988; Spiro & Jehng, 1990) can be used as a prototype for designing complex and ill-structured knowledge domains by providing multiple perspectives, cases and examples.
- Future studies should consider learner's different learning prerequisites and learning types, for instance, various characteristics such as high/low prior content knowledge/skills, field dependence/ independence and so on. Additionally, many of the independent variables associated with the study of aptitude-treatment interactions should be taken into account in the design of hypermedia learning environments (Tergan, 1997).

Conclusion

As we continue to investigate how hypermedia learning environment may be manipulated to positively influences student's learning, it is crucial that particular attention be given to guidelines derived from instructional theory and experimental methodology as well as consideration of leaner characteristics and learning styles. Only by initiating a systematic program of investigation where independent variables are judiciously manipulated so as to determine their relative effectiveness and efficiency of facilitating specifically designated learning objectives will the true potential inherent in hypermedia be realized

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Making Sense of Search Results by Automatic Web-page Classifications

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Abstract: This paper reports the development of a system for automatically organizing Internet web pages into meaningful categories. The aim of the system is to allow Internet users to find useful information in less time. The current problem with using the Internet is how to find the information that we need. With the explosive growth in the Internet, the information overload situation is getting worse. The proposed system automatically classifies web pages based on three types of information: (1) The system analyzes organizational information among web pages (inter-web-page relationship), such as an URL and links within a web page. (2) It analyzes the meta-web-page information such as data contained in META tags and formatting data of a web page. And (3), it analyzes web-page-content information such as keywords and phrases in the content of a web page. Our results show that combining all three types of information provides better accuracy.

Introduction

Although we know that "information is power," the current problem with using the Internet is how to find the information that we need. With the explosive growth in the Internet, the information overload situation is getting worse. Since currently the Internet technology is one of the most important sectors in our economies, it is of central importance for our society that we take action to address this information overload problem. Nowadays, a simple keyword search on the Internet may return thousands of web pages (even up to a million in one of our tests). To find the right information, one may have to scan the outlines of the first hundred web pages (and usually give up after that). To decrease the amount of time spent searching for the right information, it is of central importance that we take action now, before the situation becomes unmanageable.

One technique for managing vast amounts of information on the Internet is to arrange web pages into categories. From the point of view of web-page classification, search engines can be grouped into three classes: manual classification, non-classification, or automatic classification. The current status is that there is one search engine providing manual classification (www.yahoo.com), one providing automatic classification (www.northlight.com), and the rest of them either provide not classification or rudimental manual classification (AltaVista, Excite, Go, DirectHit, Google, and Lycos). Although there is already one automatic classification system available in the market, the proposed system addresses new issues (such as inter-web-pages analysis) and provides enhanced implementations (such as object-oriented data organizations and distributed processing).

The automated categorization of web documents has been investigated for many years. For example, Northern Light received a United States patent on July 13, 1999 for their classification mechanisms (Krellenstein 1999). Mladenic (1998) has investigated the automatic construction of web directories, such as Yahoo. In a similar application, Craven et al. (1998) intend to use first-order inductive learning techniques to automatically populate ontology of classes and relations of interests to users. Pazzani and Billsus (1997) apply Bayesian classifiers to the creation and revision of user profiles. WebWather (Joachims et al., 1997) performs as a learning apprentice that perceives user's actions when browsing on the Internet, and learns to rate links on the base of current page and the user's interests. For the techniques of construction of web page classifiers, several solutions have been proposed in the literature, such as Bayesian classifiers (Pazzani & Billsus, 1997), decision trees (Apte et al., 1994), adaptations of Rocchio's algorithm to text categorization (Ittner et al., 1995), and k-nearest neighbor (Masand et al., 1992). An empirical comparison of these techniques has been performed by

Pazzani and Billsus (1997). The conclusion was that the Bayesian approach leads to performances at least as good as the other approaches.

Our Approaches

Our project addressed the following four major issues for automatic classification of web pages:

(1) Develop a process and a database system to allow arrangement and storage of hieratical categories: Our strategies include using Object-Oriented database and storing the hieratical categories in a tree structure.

(2) Develop an analysis system to determine whether a web page belongs to a specific category. The system analyzes the follow three types of information: (a) Inter-web-page relationships including URL (Universal Resource Locator) and links contained in a web page: the analysis includes going down the links pointing out of a web page and checking the given URL of the current web page for information such as the type of resources and web site organization (e.g. www.cnn.com/health indicates that the web pages contained in the health directory may be health related.). (b) Meta-web-page information including HTML Meta tags and formatting data: the analysis includes checking META tags such as tags for description, keywords, section, subsection, and date. In addition, the formatting data of the web page are also analyzed (e.g. table of content or resume usually formatted in certain way). And (c), web-page-content information including keywords and phrases: the analysis includes matching keywords within a web page to keywords for a specific categories. Words appeared within some HTML tags carry more weight than others.

(3) Develop a mechanism that can learn from training web pages to identify attributes of a specific category. The learned and programmer provided attributes are then used by the analysis system. Training web pages and their categories are provided to the learning mechanism. All training web pages are initially tokenized, and tokens shorter than three characters are removed. The set of tokens (words) is filtered to remove HTML tags, punctuation marks, numbers, and stop words, such as prepositions, articles and conjunctions. Moreover, a stemming algorithm is applied to remove suffixes such as -s, -es and -ies, to preventing separate frequency counting for those words that differ in the number (e.g., computers and computer). Separate counting leads to flattening frequency histograms and has the effect of making relevant and irrelevant features less distinguishable. A selection criterion is developed to select the tokens that are best representative of the categories. Normalization methods are also used to account for difference in the number of words in the training web pages. Methods to learn from inter-web-page relationships and from meta-web-page information do not yet exist, but are being developed in this project.

(4) Develop a strategy for the proposed system to be able to port to parallel and distributed hardware platforms: Our strategies include using CORBA (Common Object Request Broker Architecture) interfaces. CORBA specifies the functions and interfaces of an object Request Broker (ORB), which act as an object bus that allows remote and distributed objects to interact.

Automatically organizing Internet web pages into meaningful categories is only a small step toward addressing the information overload problem due to explosive growth in the Internet. Other promising strategy includes using intelligent agents that learn user's behaviors and preferences. Based on the profile of the user, the intelligent agents then automatically gather information for the user.

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E-coBrowse: an Extensible Web (Co-)navigation Framework

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Abstract: We have developed e-coBrowse, a cross-platform architecture and toolkit for augmenting Web client capability, external to the browser, by dynamically rewriting page contents. With this system, developers can incrementally add a wide range of features to a popular browser, including those, which have been difficult to realize without resorting to native code or browser/protocol customization, such as telepointer, radar view, collaborative form filling, and synchronized page scrolling. Furthermore, it also provides support for state persistence, which is essential to the development of asynchronous collaborative applications.

Introduction and Motivation

Widespread use of the World Wide Web, together with the accelerated growth in bandwidth, has made the Web attractive as a platform for interpersonal communication and collaboration, even in real-time. Today many multi-user applications have been developed to run inside a Web browser. Ironically, despite longstanding interest in extending browsers with groupware features, which can be traced back to the early days of the Web (e.g., Woo & Rees, 1994, Greenberg & Roseman, 1996, Trevor, 1997), browsers continue to be supported mainly as single-user applications. The most interesting groupware extensions to browsers are related to co-navigation (e.g., Hipbone), collaborative form filling (e.g., Kobayashi et.al., 1998), and synchronous group annotation (e.g., Pacific & Youssef, 1999). Although these group features can be found in a number of research and commercial instances, none of them are extensible systems. In particular, they do not allow users to create features which meet a specific need or decide which features to add to their browsers for the page they are visiting.

Our primary goal is to address the lack of extensibility support found in today's browsers, while meeting the need for a solution that will work for the leading browsers, Netscape and Internet Explorer. Solving this problem not only will users be able to dynamically augment their browsers with a range of network features (e.g., co-navigation), but also local features (e.g., a dictionary or translation utility), as they browse the Web together or independently.

In order to realize this goal, we have developed e-coBrowse, a web co-navigation system that supports extensibility and development of new features for Web browsers, without using plug-ins. The system has been tested successfully on Internet Explorer 5.0 (IE) and Netscape Navigator 4.7 (NN). Since e-coBrowse is implemented using a combination of JavaScript and Java, it is less susceptible to platform differences. But, due to diverging browser designs (e.g., event model), browser-specific code is necessary. Extensibility is realized by dynamically augmenting retrieved documents with system and user-defined add-ins before passing them to the browser. Add-ins can be just about anything that can display or run inside a Web browser. Hence, they can be client-side features (e.g., scripting languages), server-side features (e.g., servlets) or a combination of both. Add-ins can also interact with local applications that are outside the browser from the client file system. In this way, e-coBrowse can tap into many existing applications and help harness advances in Web infrastructures and programming languages (e.g., JavaScript and DHTML) in order to support collaboration while browsing. For example, chat and telepointers can be inserted in every page you visit. In addition to this flexibility in development, e-coBrowse provides programming abstractions and support for building groupware add-ins (e.g., a shared data model). When add-ins are carefully designed, they can operate across browsers. Moreover, because e-coBrowse extensions are external to the browser, modification to the browser is not necessary, apart from configuring it to use a proxy server that runs on the client PC. When these extensions are not in use, the client-side proxy can be controlled to work as a normal caching proxy (i.e., HTTP streams are not rewritten). Thus, there is no need to reconfigure the proxy setting in the browser when switching to normal browsing.

The remainder of the paper is structured as follows: First, some examples of how e-coBrowse might be used as the basis of different collaborative services are presented. Second, the design of the system architecture is described. Third, the key features of the e-coBrowse toolkit are introduced along with the workflow of how a complete add-in application can be built. The last section contains our concluding remarks and an outline of the ongoing work.

Prototypes based on e-coBrowse

E-coBrowse is part of a larger project, the Virtual University Initiative – a multi-mode learning platform under development at the United Nations University (Chong & Sakauchi, 2001). We are currently using e-coBrowse to develop Web-based collaborative learning tools and study human computer interaction issues in the domain of multi-user browsers. Beyond URL synchronization, a wide variety of other applications can be built with the framework. To illustrate the potential of e-coBrowse, we describe some of these applications below:

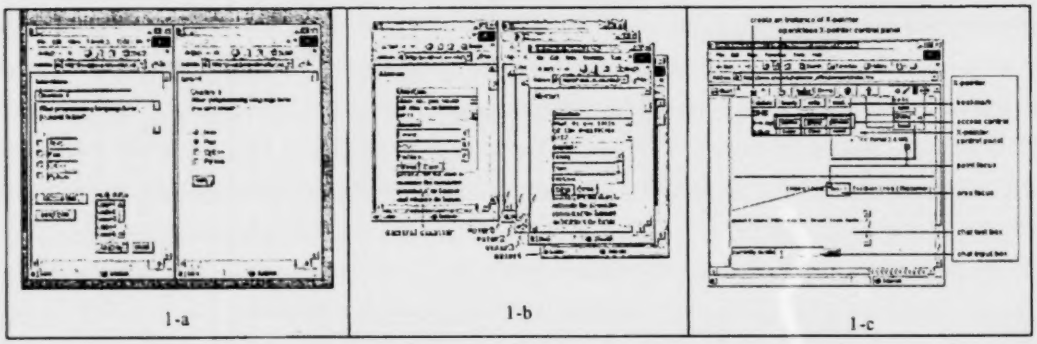

Figure 1: Samples of multi-user add-ins running on top of e-coBrowse

Figure 1-a describes an application where custom forms can be sent to users on the fly. Although the scenario depicted corresponds to a job interview, it can also be used as a quiz tool in distance education. The interviewer has access to a set of form templates, which can be used to generate customized interview questions. The form is sent to all the job applicants joining the interview. After filling out the form, the job applicants return it to the interviewer. At that time, the interviewer's screen is updated with the names of those who have just submitted the form and their responses can be reviewed.

Figure 1-b demonstrates a slightly more advanced form-based application. The form implements the semantics of a real-time poll. The application consists of a vote counter and a number of clients that act as voters.

Figure 1-c showcases another interesting application we have developed. It is a Web annotation tool featuring a pointing device that connects any DHTML-compliant portions of a Web page to a variable number of annotation effects (e.g., bookmarks and chat) known as X-pointer (Chong & Sakauchi, 2000). These effects are merged into the original document as separate layers at document retrieval time. The pointing device can behave either as a tele-highlighter (region focus) or tele-pointer (point focus). The annotations can be for personal use or sharing in a group.

System Architecture Design

There are many ways to extend browsers with extra capabilities, all of which either modify or extend some aspects of the client-server model of the Web infrastructure. The changes vary with different degrees of transparency to the server, browser, and user. These can be broadly classified into three categories: Web server customization, browser customization, and external extension. This problem has also been the subject of study, most notably in the context of Web annotation systems (Yee, 1997, Vasudevan, et.al, 1999, Zohar, 1999). We show that some of the proposed solutions can be adapted and applied towards the design of e-coBrowse. The main idea behind e-coBrowse is to allow users to dynamically incorporate new functionality in arbitrary web pages while browsing together or individually. This would have the same effect as if the browser were augmented with new capabilities. Our design rationale is given below.

The requirement that the custom features should work with any page accessible from the Web renders the first category impractical. CoNote is an example of using this approach (Davis, 1994). Browser customization affords developers complete control of the custom features. Current implementations are based on plug-ins, native-code browser interface calls (e.g., ThirdVoice and JotBot (Vasudevan, et.al., 1999)), proprietary/new browsers (e.g., Greenberg & Roseman 1996), or modified mainstream browsers (e.g., Netscape Conference). The main problem with customized browsers is their dependency on a specific browser and platform. Since a large installed body of browsers already exists, many users might not want to change their current browsers (or lose their bookmarks). Arguably, a different plug-in could be prepared for each browser and platform, but it would not be a very practical solution, particularly when plug-in programming is in general complex. This narrows the design space to extensio ns that are external to the browser. The variations within this category include application sharing and proxy intermediation. In application sharing, the sharing-enabling environment needs to be started before the browser can be shared, e.g., NetMeeting. Additionally, sharing-enabling environments that are cross-platform, like Disciple (Li, et.al., 1996), require that the browser be written in a language compatible with the system. This severely limits the choices of browsers that can be shared.

Proxy intermediation can be used to achieve both cross-platform extensibility and seamless integration with existing browsers. Since current browsers already support connection to a proxy, browser modification is not necessary. Proxy intermediaries lie along the path between the browser and Web server (Barrett & Maglio, 1998). They can access and modify the Web transaction data (HTTP request/response streams) to synthesize the desired functionality. E-coBrowse is based on this approach. Previous proxy-based solutions replace every URL with customized functions. This adds performance overhead to page loading. Instead our current implementation merges code into the original document at retrieval time. For this method to work for any pages, interference of our code with user's code must be handled.

Figure 2 shows the software components of e-coBrowse and their interconnections. Proxy intermediation is realized through the client-side intermediary agent in the architecture. Similar to annotation systems, browser requests are used as triggers to actions for modifying the default behavior of page retrieval. But, the similarity ends here. We take this idea a step further to support not only annotation, but also a range of browser extensions by providing a runtime infrastructure and a development toolkit. These extensions can be written in any language as long as they can be included as part of a HTML document.

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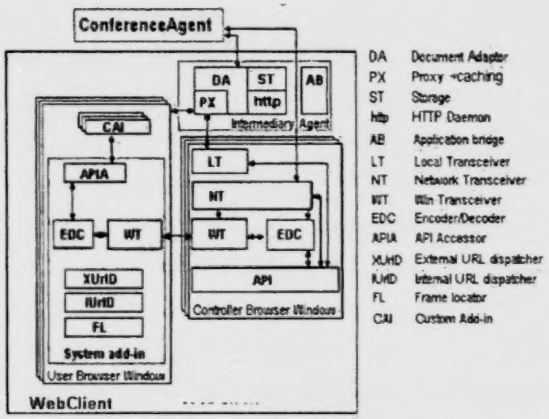

Figure 2: Software architecture of e-coBrowse

E-coBrowse Toolkit – an Overview

With the e-coBrowse toolkit, developers can easily build add-in tools and applications that enable users to participate in a community network while browsing. The key idea in the toolkit is a shared data model based on the metaphor of virtual rooms (VR). A VR is instantiated every time a conference session is started. VR interconnects the web client states and participants' file systems together. Participants can share a document by copying the file to a directory that is reserved for e-coBrowse. The shared directory automatically appears as a home directory under 'user' in the VR created for the session, much like a file system mounted on the file system hierarchy in Unix. The directory structure of VR is shown in Figure 3.

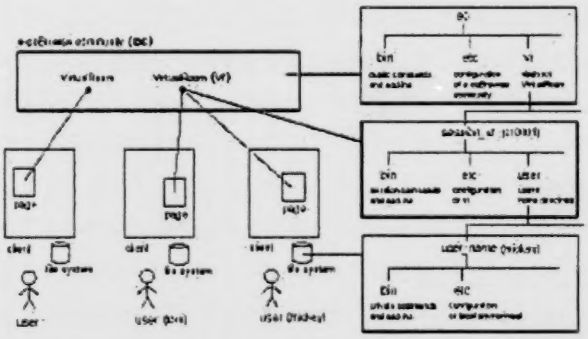

Figure 3: Logical view of the e-coBrowse community that integrates web clients' states and portions of their logical file systems in a single namespace that resembles the Unix file system.

At the root of VR, the 'bin' directory contains the e-coBrowse functional extensions that are visible to all the users in the session. These extensions can be accessible as add-ins that are merged into a retrieved web page or commands that run inside a shell console. The 'etc' directory contains configuration information about the current VR, such as session profile and sharing policies. Likewise, the private per-user counterparts can be found in the 'user' directory. At the top level of the shared data model is the e-coBrowse community that bridges the distributed VRs together in a single Unix-like namespace for accessing and manipulating data within and across VRs. Similar directory structures also exist at the community level.

Toolkit Architecture

The toolkit is still evolving, but it already contains quite a few high-level primitives that bring simplification to writing many forms of groupware add-ins. Furthermore, through the Application Bridge local applications external to the browser can also access the various APIs defined in the toolkit. Figure 4 shows the main layers of the toolkit architecture. The complete documentation of the toolkit is available at:

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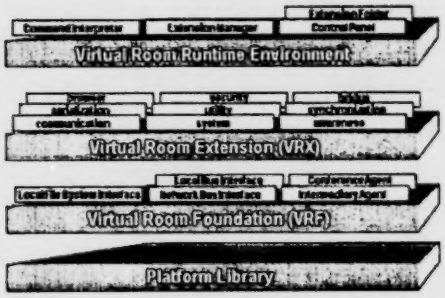

Figure 4: Architecture of the e-coBrowse toolkit

http://vulab.ias.unu.edu/e-cobrowse/developers/toolkit/ Here we give a summary of the key development support features.

VR Runtime Environment

The VR runtime environment provides mechanisms for managing extensions and a shell console where traditional Unix utilities such as ls, cd, mv, cp, more, cat, and rsh, can be used to navigate through the e-coBrowse community, and access the state or change the behavior of local/remote web clients directly. In addition, an add-in or a command can use the shell console to print out information useful for debugging purposes. Figure 5 shows a snapshot of the default GUI of the VR runtime environment. Using the extension manager, developers can query, update, share, and

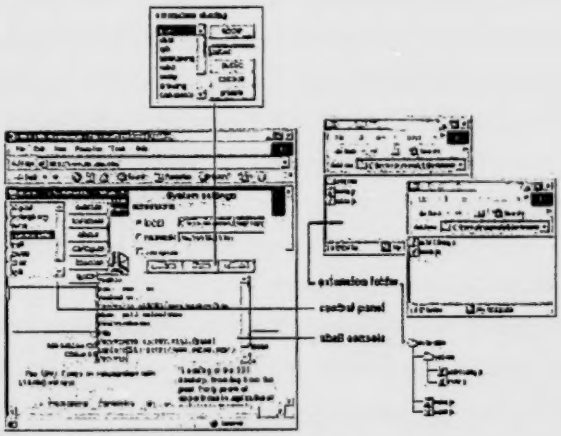

Figure 5: End-user view of the VR runtime environment, where extensions can be shared locally inside a VR or globally across the e-coBrowse community

upload individual add-ins and commands. Each add-in can have its own configuration interface and startup parameters. The control panel provides direct access to these settings. At the minimum, users need to login through CA before they can access the VR runtime environment. Subsequently, users can be directed to an application-specific session manager. Using the session package in VRX, developers can write their own session managers (e.g., public or invite-only subscribe policies). There is only one control panel per Web client. Even in the case of a session containing multiple spawned browser windows and pages with several frames, it is only shown once. However, add-ins can be launched in a specific window and a specific frame.

Packages in VRX

A developer will find the VRX layer as the main entry point to the e-coBrowse toolkit. The packages in VRX are organized into the following programming abstractions:

- Awareness. This provides supports for realizing group awareness through automatic event notification (e.g., peers' cursor positions) and on-demand event monitoring of user actions ((e.g., peek at someone's screen) and browser operations. A participant's presence (e.g., someone who just joined a session) and current view (e.g., when a particular DOM object has changed) are some of the events that can be trapped.
- Browser. This enables programmers to manipulate behaviors of remote browsers (e.g., replace the URL in a certain browser window).
- Communication. This provides programmers with a common data path, VRBus through which they can share data, methods, and events among members joined to a same VR.

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- Synchronization. This supports client-to-client synchronization within the same VR. VRX understands five different types of events, which can be monitored and processed with default or user-defined handlers. Browser events include page change, page scroll, window resize, and input events. DOM events include explicit changes made in DOM objects from program code (e.g., propagate the changes in a textarea element inside an HTML form, see Figure 6) and input events on focused DOM objects. Session events are generated when joining/leaving a session and requesting the floor control. Message events are user-defined events that can be pushed to the peers via message passing mechanisms. Method events are the last type and allow methods to be executed at the specified peer clients' browser windows (e.g., insert a dynamically generated DOM object and place it anywhere on a remote page). In addition, the package provides support for redirecting input events targeted to a (possibly remote) DOM object to another web document. This feature finds many uses in client-server programming. The client-server poll application described in Figure 1-b is an example of using remote event monitoring.

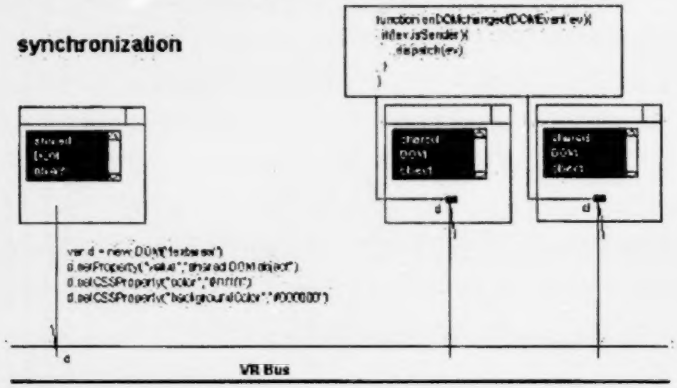

Figure 6: An example of automatic notification and propagation of explicit changes in a DOM object to peer browsers connected to the VR Bus.

- Serialization. This provides a structure-preserving uni-dimensional abstract data type for save and restoration of object or application state. In particular, recursively nested lists are used to assist programmers with their needs for passing complex data across the network or store them in a file system.
- System. This contains methods to access the VR runtime environment.
- Bridge. This provides the means to start a local application and maintains two-way communication between the local application and add-ins.
- Utility. This includes general data abstract types such as hash tables.
- Security. This allows programmers to assign custom security policies to each file and transfer data using secure communication.

How to write an add-in? – an example

Figure 7 traces the sequence of steps for sharing and executing the poll add-in from the VR runtime environment. The application semantics dictate that there should be exactly one central counter in a session. Because the same poll add-in program is running on each connected browser, the view and behavior need to be differentiated based on the role assigned to the individual add-ins. Step 3 shows how the role for the local instance and peer instances of the program is initialized through the custom 'execute' handler. In this example, pressing the 'execute' button only starts the local copy of the poll program. The user enters the poll question and choices in step 4. When the user presses the 'send' button,a separate copy of the poll program starts in the peer browser windows. The annotated source code in figure 8 shows the implementation details of the remote execution and client-server logic of the poll program.

Two methods from the VRX package greatly reduce the programming complexity. The remote execution is based on the exe() method from the System package. The votes are directed to the counter by using the redirectBrowserEvent() from the Synchronization package. This method intercepts mouse-click events originated from the 'send' button on the voter clients and directs them to the central counter client. The result is that these events are processed on the central counter, but not on the voter clients.

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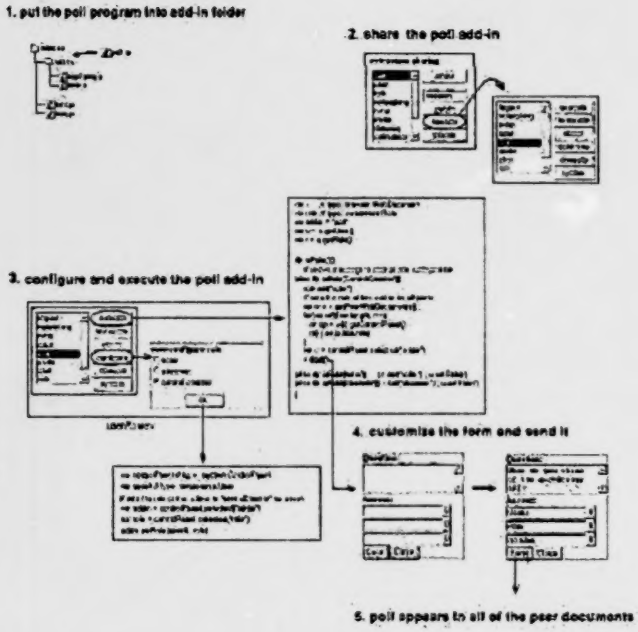
1. put the poll program into add-in folder
2. share the poll add-in
3. configure and execute the poll add-in
4. customise the form and send it
5. poll appears in all of the peer documents

Figure 7: Snapshots and code show how the poll add-in can be shared and executed in e-coBrowse

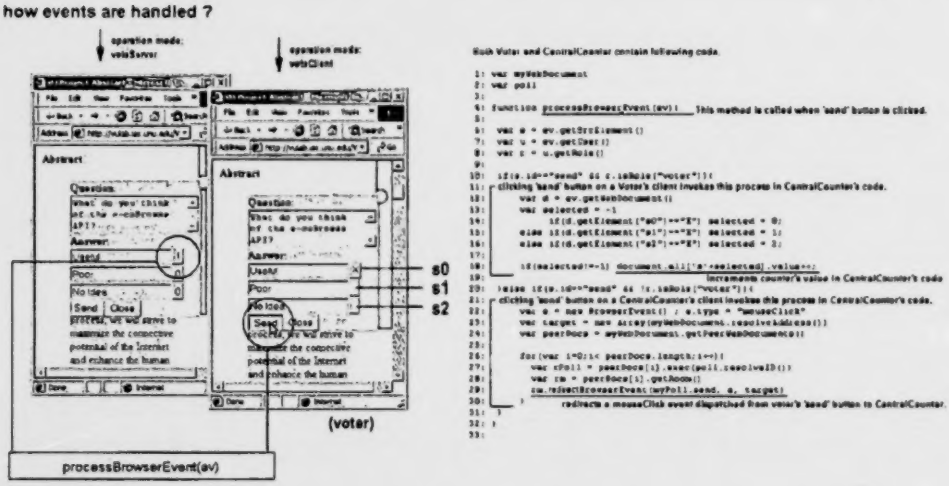

Figure 8: The source code of the event handler for the SEND button

Conclusions

At this point Web browsers have not found a satisfactory transition into the realm of groupware applications. This is in contrast with the relative success of the Web for running these applications. In this paper we have described a methodology to turn a common Web browser into an extensible browser with capabilities for supporting a range of custom single-user/multi-user enhancements, combined with synchronization of Web pages and users' actions inside browser windows. Our main contributions are threefold. First, enhancements are available through a cross-platform and browser independent infrastructure that runs alongside an unmodified standard browser. This will facilitate widespread deployment. Although the current implementation requires users to configure the browser to communicate through the intermediary agent, this does not interfere with regular browsing since the intermediary agent can also function as a normal caching proxy. Second, new features can be

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dynamically added to and removed from shared Web pages being visited during a session through an intuitive runtime infrastructure. Even when a website is not originally designed with groupware features it can be shared in a very customized way. As the rewriting process does not place any restrictions on the language or programming model (client-side, client-server, or both), a wide range of features that can take advantage of the evolving web infrastructures can be incorporated in any web page. Furthermore, the support for sharing add-in applications fosters the formation of online communities of developers. Third, the framework provides a toolkit that supports the development of groupware tools and applications that can be closely coupled with page sharing and co-navigation. The toolkit also provides a serialization API that can be readily used to support latecomers. We expect that this tight integration will give rise to new usages of the Web and help maximize the connective potential of the Internet.

We are currently investigating a new architecture to realize the features of e-coBrowse without the need of a proxy and evaluating the framework in the further development and testing of our Web annotation system (see Figure 1-c). In the futur e, we will continue to evolve the toolkit and adapt the framework to new Web technologies.

Acknowledgements

This work is supported in part by grants from the University of Tokyo. The authors thank Michihiro Yamamoto for invaluable contributions to the implementation of the system.

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Transcending Distances and Differences with E-learning Technologies

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Abstract: E-learning is the fastest-growing technology tool both in university education and in business training. Universities are doubling the number of distance learning courses and degrees they offer. Many businesses are finding anytime, anyplace training more convenient and less costly in terms of lost employee time than onsite workshops. Asynchronous systems overcome the problem of involving participants from different time zones and distant countries.

Web-based learning technologies create an environment that minimizes many of the differences between learners and, as never before, provides a level playing field for everyone. Status, gender, age, race, religion, learning styles and even physical disabilities all fade into the background. The speaker will share from his fifteen plus years of teaching some 6,000 people online in over forty different countries for seven separate organizations. The presentation will cover both tips for teachers and trainers in content design and delivery as well as describing some of the technological considerations that software programmers and web designers need to keep in mind to ensure that their design does not create new and needless barriers for users with disabilities.

Introduction

Different E-learning Systems

What began as correspondence courses and then graduated to telecourses broadcast before sunrise has been transformed into satellite telecasts with or without two-way interactivity and increasingly has become web-based courses delivered over the Internet. They may use video, audio, telephone, text on the web, graphics on the web, synchronous or asynchronous, and more. In some cases it means connecting two rooms of students across many miles by telecommunications. In other systems, each student is located at a different place. The problem for a discussion about E-learning systems is that the speaker and audience may have very different systems in mind and may not actually be communicating with each other. For this presentation, we will limit the discussion to web-based systems with the addition of e-mail. The web-based material may include text, graphics, video and audio. It may be either synchronous or asynchronous. Learners, in our model, will not be working together from a classroom setting but rather each learner will be connected from different locations. This is not independent learning as courseware facilitates groups interacting and working together.

The Medium is the message

In face-to-face learning situations, body language enriches and enhances the communication. How something is said may be as important as what is said. Besides so-called body language, the tone of voice itself is frequently an important part of the message. Some people compensate for this by adding pictures of smiling or frowning faces to help clarify their words. I can't imagine Johnson or Boswell drawing cute pictures on their extensive and rich correspondence. Masters of the language in the past were able to convey subtle meanings by carefully selecting their words, but a media generation such as ours has lost that kind of verbal finesse. Linguists have found that the writing style of e-mail and other electronic writing such as discussion boards fall somewhere between written and

oral language. Rather than lamenting a decline in writing sophistication, E-learning instructors need to understand the medium and find its strengths and weaknesses. This informality actually reflects how it is used. It tends to encourage spontaneity and a more relaxed, somewhat personal interaction. While it is not usually used for long thoughtful communication, it does permit editing and permits reading a message before sending it. It is usually more thoughtful and considered than is a purely oral exchange. It can be used for group discussion similar to a classroom, but it also allows students to think at least briefly before participating. Shy students frequently are not as intimidated as in a face-to-face situation. It permits anyone reading and rereading someone's comment before replying which a face-to-face setting does not. An instructor can answer a particular question at length even though most of the students understand the topic and do not need that detailed explanation. Those students can skim or skip material they understand and move ahead quickly to the topics they find most relevant. I am assuming that most of these ideas are familiar to most people, but I want to touch on it as a backdrop for talking about the inclusion of people with disabilities.

E-learning Systems and Students with Disabilities

Types of Disabilities

People all have a wide spectrum of abilities and disabilities. In a discussion of E-learning we will focus most on people who have been seen as print disabled—people who have severe problems in reading typical printed materials. When the material is transformed from print to a digital format, it lends itself to a wide variety of display formats and systems which has the potential of practically eliminating the print disability altogether. Those who have been print disabled usually includes those who are blind, who have very low vision, people with various types of learning disabilities and people with some motor impairments which prevent their holding books and turning pages. In that modern computers are all becoming multimedia machines, and in that video and audio is becoming more common on the web, we need to add the Deaf and the hearing impaired to those impacted by E-learning systems. There are, of course, a number of other disability types, and I do not want to minimize their problems. However, these are the groups that are most impacted positively and/or negatively by E-learning systems.

Adaptive Technologies

The display independence of digital information is the key to providing access to users with disabilities. Students who are blind can use screen-reading software with speech synthesis to "speak" what is on the computer screen. This provides access to textual materials, but confronts problems in providing access to graphics and images. Screen enlargement software can let a user with severely limited or low vision manipulate the size of text and images on the monitor and also alter its colors when the color presents a problem. Students with learning disabilities may also benefit by enlarging the material and thereby limiting the amount of distracting material on the screen and enabling the person to focus on a small portion of the information at a time. There are alternative input systems to permit users with little or no hand use to control the computer and navigate through text and pictures without assistance. Alternative input systems include keyboard alternatives, mouse alternatives and, perhaps most popular, voice recognition. The Deaf and hard of hearing have problems with audio and video on the web. However, we have not yet reached the point where voice recognition software can take an audio or video and automatically output a text transcript. This still requires considerable human intervention to create and post the transcript.

Textual material can readily be used in web-based E-learning courses and be fully accessible with the use of standard adaptive technologies. There may be some problem for the Deaf if they are primarily sign language users. ASL is not signed English but another language, and English text is, in effect, their second language. Of course, because electronic communication tends to be less complex than most written language, this in itself is a help. Graphics and images are certainly useful for the Deaf and for many learning disabilities. Unless the vision of a low vision person is too bad, screen enlargement should provide reasonable access. Screen reader users have a problem and require either a text label identifying the image or sometimes a longer description of the graphic. Audio on the web works well for the users who are blind or low vision. It works well for most people with learning disabilities. It is a significant problem for the Deaf requiring making a transcript available. Video is a complex medium, and it creates more or fewer problems depending on what it is. If it includes someone speaking and conveying important information, then there must be streaming captions to accompany it. (Putting a captioned videotape on the web does

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not work as the compression on the web renders the original captions unreadable.) If the video has a lot of action and complex images, it may be problematic for many with learning disabilities. If it includes a number of important and small items, someone with low vision may miss those. It is not very feasible to combine screen magnification and video. While the user was scrolling the screen magnification to focus on an item, the video would have moved to another image. Finally, students who are blind will have no trouble in following the voice track on the video, but if there is a lot of activity that is not directly reflected in the sound, you may need to add an audio description of those parts of the video for them to understand its content.

Courseware Interface

Choosing for Accessibility

There are many reasons to select one package or even creating your own system. The system needs to be easy for faculty to create their courses, and it must meet the needs of the administration to run on existing platforms and to interface with other record systems. It must also be easy for students to use and navigate. One group of students who have been frequently forgotten in making the selection are students with disabilities. Courseware vendors frequently justify their previous lack of attention to these needs by saying that no one ever requests it of them. Colleges and universities can do a lot by becoming noisy consumers and demanding that courseware products be made fully accessible. In the past year vendors are taking accessibility for students with disabilities more seriously. Asking the vendor to explain which parts of their system are accessible and which parts are not and demanding to know when the process will be completed is the first and easiest step. Like in many other software and hardware purchases, buyers need to check for themselves. Have someone on campus or a consultant check accessibility for you. One other simple test is to turn images off in a browser and to navigate using the tab key rather than the mouse and walk through several pages.

Who's Responsible?

If the courseware you purchase is not actually accessible, who is legally responsible if, in fact, it is found to be a civil rights violation? The correct answer for me to give is that you should consult your lawyer. As most people seem to read the law, however, the school, university or provider of the online training is responsible to give training that is accessible. There is legislation about providing equal education. There presently is no legislation requiring creating accessible software. The revised section 508 of the Rehabilitation Act mandates federal agencies to only buy accessible software, but it does not itself prohibit creating inaccessible software. This would seem to mean that you could end up purchasing inaccessible software, and you might be required to make your online training accessible but not even have access to the software code. If you won't be able to fix it, making the correct selection in the first place is the only meaningful alternative.

Web Accessibility

The World Wide Consortium has established the Web Accessibility Initiative to establish guidelines for making web pages accessible to a variety of users with different disabilities. It has developed a set of content guidelines, a set of quick tips and is also developing guidelines for the designers of authoring tools. Reading these materials will help you in selecting courseware and in helping your instructors post course materials that also are fully accessible. These materials are on the web at http://w3.org/wai. In the summer of 2001, the Federal Access Board's standards for web design developed under the Federal Rehabilitation Act revised Section 508 came into effect. While these are similar to the Web Accessibility Initiative's guidelines, they have some differences and have the force of law for any agency covered by Section 508. The major differences from the WAI guidelines is that these are standards that need to be stated in terms suitable to adjudication rather than merely being guidelines. These can be found at http://www.access-board.gov. WebAIM is a Learning Anywhere Anytime Program project with a number of useful resources at http://www.webaim.org.

Accessible Course Content

My Experience

This field is so new that there are no real experts. I have been teaching online since the early 1980s and have taught some 5,000 students in over 40 countries and have taught for five different university distance learning systems as well as teaching extensively for EASI. Others will have different experiences, and their insights are equally valid to mine. I can only share my experiences and what I have learned from them. IT'S ABOUT PEOPLE, NOT TECHNOLOGY. When you first start using technology to deliver material, the temptation is to focus on technology and how to use it and to almost forget the student. Find the simplest way to use the system and try to make it as invisible as possible for yourself and, above all, for your students. Remember the student with a disability is interfacing your material through two layers of technology, the courseware and the adaptive technology. The more you do to show off the technology and your use of it, the more likely that the student will focus on it and not on your content. Also, in thinking of your students with disabilities, think of them as STUDENTS with disabilities. Do not think of them as a disability but as a student. The National Science Foundation found that the major barrier to student success in science courses was not the material but social attitudes. KISS: KEEP IT SIMPLE STUPID! Simple and simplistic need not be identical. Do not dumb down the content, but present it in as simple, clear and straight forward a way as possible. Frequently being overly pedantic is a way to hide lack of content. Saying something complicated in a non-complicated way takes more work, but clear communication is good teaching. While this should help everyone, it can be of special value to Deaf ASL users and to learning disabled students.

Be Accessible

Some instructors are naturally relaxed and friendly while others seem formal and intimidating. I don't advocate that you try to create a false computer personality, but even teachers who are somewhat socially inhibited can find ways to let students know they are approachable. A student with a disability may well be shy about their situation and may fear rejection or prejudice from a faculty person. Find ways to reach out so that students with problems will not be afraid to ask for special help when they need it. At the same time, however, there are students with disabilities who exploit their disability to manipulate people around them. You should not be their social worker, and you need to know where you will draw legitimate boundaries.

Use Redundant Communication Modes

Different student have different learning styles. Universal teaching is teaching that seeks to reach everyone or as many people as possible. Frequently, education as aimed at a segment of learners, the middle ability students or the above or below average. One advantage of asynchronous online learning is students can skim over what they know or repeat some information several times. Learners can work according to different styles and different abilities. This makes it possible to design content differently than for a live classroom. It is difficult to have people working at differing paces in a room, but it is quite easy to do online. Instead of having to aim at a segment of the class, the teacher can design for a much broader ability spectrum. Besides accommodating learning styles, it can assist users with disabilities and with adaptive technology interfaces that may make learning slower or harder. Besides modularizing the material, use text, graphics, and when possible include audio and video media.

Designing for Accessibility

Most of the web design issues relate to the courseware interface itself. Much course content can be posted to the system without much concern about web accessibility issues. Whenever an instructor begins including graphics, media and some more complicated format items, problems may arise. While faculty or instructional technology people may not need to be web designers, it will help if someone involved with course production has an awareness of the most basic problems and knows where to find solutions. Perhaps the simplest introduction to the subject of accessible web design is WAI's ten quick tips, which are duplicated here.

1. **Images & animations**. Use the alt attribute to describe the function of all visuals.

2. **Image maps**. Use client-side MAP and text for hotspots.

3. **Multimedia**. Provide captioning and transcripts of audio, descriptions of video, and accessible versions in case inaccessible formats are used.

4. **Hypertext links**. Use text that makes sense when read out of context. For instance, do not use "click here."

5. **Page organization**. Use headings, lists, and consistent structure. Use CSS for layout and style where possible.

6. **Graphs & charts**. Summarize or use the longdesc attribute.

7. **Scripts, applets, & plug-ins**. Provide alternative content in case active features are inaccessible or unsupported.

8. **Frames**. Label with the title or name attribute.

9. **Tables**. Make line by line reading sensible. Summarize. Avoid using tables for column layout.

10. **Check your work**. Validate the HTML. Use evaluation tools and text-only browsers to verify accessibility.

Special Solutions for Special Problems

There are three areas that cause more serious accessibility problems. These are captioning of streaming video on the Internet; complex graphics, drawings and maps; and complex mathematics.

Video captions cannot be done by streaming captioned videotapes. The process of providing Internet captions first requires getting a verbatim transcript. Then using SMIL (synchronized multimedia integration language) you create a file with time stamps in it. This file controls the synchronization of blocks of text with the audio on the video. This is a time intensive process especially for someone with limited experience. It is a job you might want to outsource.

Providing access to complex graphical material for students who are blind will require providing hard copy tactile graphics. If you have enough need to do this, you may want to set up a process to do this. If your needs are more limited, you may want to outsource this too.

Complex math is another problem for students who are blind. It is almost impossible to render complex formulae verbally either with audio or with a text description. Presently many symbols can only be represented on the web by a graphic. While this may change in the future, presently providing hard copy Braille is the only true way to provide full access. There are Braille embossers and software translators to assist with computer generated Braille. For literary Braille this is quite simple. However, math requires a special Braille code, Nemeth Braille and producing complex Braille math demands human intervention and control. For large amounts of Braille math, you may want to develop these skills. For smaller quantities, you may consider outsourcing.

Conclusion

Adaptive computer technology has opened the world of information for many people with disabilities like nothing before in history. Because E-learning is accessed by computers, it can provide a more level playing field for learners with disabilities as nothing else in education. In its early years, E-learning has frequently contained many needless barriers for these students. With its growing use across more courses on all campuses both on campus and in distance learning, these problems can no longer be ignored. They will have to be rectified. Retrofitting can be expensive. Therefore, institutions need to consider accessibility issues as soon as possible in the creation of their E-learning infrastructure. They also need to provide some awareness training and technology support for faculty and instructional technologists.

EASI is the premiere provider of online training on how to provide a barrier-free learning and workplace. Many of EASI's leaders have had their lives transformed by these technologies. Others have worked in support positions where they have watched this impact on others. We are dedicated to extending this power to others like ourselves. EASI has recently partnered with the University of Southern Maine to provide a Certificate in Accessible Information Technology all delivered online. Courses include Barrier-free Information Technology, Beginner Barrier-free Web Design, Advanced Barrier-free Web Design, Barrier-free E-learning, Business Benefits of accessible Electronic and Information Technology, Accessible Internet Multimedia Production, Accessible Information Technology for persons with learning disabilities and Train the Trainer. Information is on the web at http://easi.cc/workshop.htm. These courses are designed to cover all the on campus and Internet facilities of schools, colleges, universities and of other information providers.

VIRTUAL CAMPUS CONTRIBUTION TO THE EMERGENCE OF A NEW PARADIGM IN E. LEARNING

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Civiletti, Maria Vittoria
Santos, Ana Maria Rodrigues
Lima, Clarisse Olivieri

UGF Virtual Campus
Distance Education Unit
Gama Filho University
Rio de Janeiro
Brazil

We are living the end of employment and the need of a strictly qualified hand labor and the beginning of "employmentship" and the need of a dynamic and thinking worker (solution creator brains). In this context, it is essential to "learn how to learn", making academic qualification continuous and perennial, not limited to the schools' borders. In what concerns to the relationship with knowing, facing the amount of available information, it is more important to create knowledge to new problems through existing information than to simply know how to absorb it in an accurate way.

How to include these new necessities in the teaching-learning process?

How to promote knowledge accessibility to a broader amounts of people, continuously, making flexible space-time boundaries?

The work done by the Universidade Gama Filho (UGF)'s Virtual Campus will be discussed. It offers on-line courses and virtual libraries to teachers and students from *educação básica* based on a new paradigm of the teaching-learning process.

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E-learning or e-Lemmings? Who pipes the tune?

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Abstract: This paper urges a rather more critical view of e-learning than that taken to date. It is argued that strong forces are converging to redefine education as a commercial rather than public activity, of which e-learning is one element. Inherently different perceptions of the teaching and learning process, based upon a commercial rather than a public model, combined with a certain amount of naïve technological progressivism are challenging the role of higher education. Poor implementations based upon flawed assumptions are also likely to lead to an e-learning bust in much the same way as the dot com phenomenon has collapsed under the weight of its own hype. The case is argued for diverse and informed models of education (including e-learning approaches) that nurture local cultures and values, and produce socialized, adaptable and capable citizens rather than captive globalised consumers, colonized by monoculture online.

1. Introduction

A powerful and persuasive set of forces are converging to reinforce the spread of e-learning across the globe. These imperatives do however beg the question, is the distinct role and contribution of Universities and academic education programmes being lost? Are Etraining and Eeducation being confounded in the e-learning space? Who is driving the agenda and to what end?

2. The Case of IT education

If we take as one example the issues facing computing and Information Technology (IT) education, they may serve to illustrate the point.
A global shortage of IT professionals means that companies in many parts of the world cannot fill positions. Hughes (2000) observed this *inability to meet demand* and the *growth of consumerism* in education as two key challenges for IT education. Others have noted that increasing diversity in the computing student body brings with it "changing modes of study: more re-education, more mature students, more non majors, more hybrid degrees and study programmes" (Daniels et al., 1998).
Adapting to these needs has generated strategies such as greater immigration, more specific skills based commercial courses, wholly work based learning, increased private commercial training provision, combined academic and certification programmes being offered in academic environments e.g. The UTS Master's in Internetworking as a by product of which graduates gain CISCO certification, (Hughes, 2000).
E-learning is an obvious method addressing the need for flexible modes of delivery. Elearning is being promoted as a strategy for IT training by companies such as Smartforce (2001), and "Information technology companies such as Microsoft, Oracle Cisco, IBM and Hewlett Packard do most of their training online" (Baer, 2000), while an increasing range of web based course delivery approaches are also being adopted in academic environments. It has been suggested that for many commercial organizations "moving from online training to higher education is a natural extension" (Baer, 2000).

3. Combining Information Technology and Pedagogy

Before further exploring the question of e-education, the relationship between information technology and sound educational practice will be reviewed.

Leidner and Jarvenpaa (1995) in the MIS literature have discussed educational uses of IT and proposed a theoretical framework within which to position certain technologies and pedagogical strategies for IT use. This framework identifies some key assumptions about knowledge, theories of learning, reality of context and the learning environment, within which educational practice and technology can be positioned. An overview of the framework is depicted below as Figure 1. These approaches to learning are quite varied both in style and outcome.

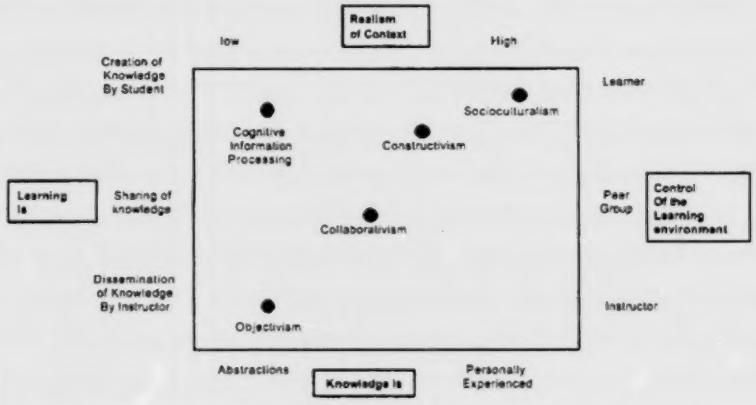

Figure 1. The Dimensions of the Learning Theories (Leidner & Jarvenpaa, 1995)

The traditional instructor-led learning style (Dale Spender's (1996) *sage on the stage),* resides in the dimension of *Objectivism* and underpins many largely teleological theories of instructional and curriculum design (Bruner, 1966, Gagne et al., 1988), namely the pre-packaging and doling out of parcels of measurable and assessable knowledge by the expert to the learner. This model might be termed "*education as knowledge transfer*".

Much work in interactive and multimedia design has been concentrated upon the dimension of *Constructivism* (Reeves, 1992), to design and create virtual worlds with which the learner can interact in order to create their own forms of knowledge in ways that are meaningful to them. This model might be termed "*education as knowledge construction*".

In my own work involving international collaborative learning (Clear 2000, 2001), I have experimented with the dimension of *Collaborativism,* using web-based groupware as a compatible combination of IT and pedagogy to support this form of learning. This model might be termed "*education as knowledge sharing or co-creation*".

I will now suggest that much of what is called e-learning, especially that based upon the commercial pre-packaged learning management systems such as *Blackboard Course info* and *Web-CT* tends to be objectivist in pedagogical style, that is it is based largely upon the model of "education as knowledge transfer". Thus content management is given undue emphasis, and the educational focus is restricted, being based upon a limited view of teaching and learning. This form of e-learning might be better termed e-training.

I would suggest that moving from e-training to true e-education and e-learning presents a far harder challenge, and one with which those who possess different world views and perceptions about the teaching and learning process will struggle. While we have made some progress in our understanding of what might work online, combining truly transformative models of education with the transformative capability afforded by information technology, is the challenge that e-learning has still to address.

4. The Discourse of Enterprise versus the Discourse of Community

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4.1 The Nature of Information Technology

In wrestling with the educational and social issues arising from my own work with international collaborative learning (Clear, 2000), it occurred to me that one needs to look far wider than the technology itself to comprehend some of the conflicting forces that contend in the e-learning space.

I was given cause to reflect through a critical incident, in which an email was sent to me, prior to an international collaborative trial, from a student in the class. The relevant comment is excerpted below:

> *Do not forget that students are the customer, [AUT] is just lucky that we are more locked in to the degree by the time that we get to the professional studies that to not come back would mean that the time you have spent at [University] was a waste.*

This increasingly common student view certainly does not reflect my own, nor that of the University. For instance Horsburgh (1996) has stated clearly, "Education is a participative process, students are not products, consumers or customers. They are participants".

So, is the simple act of introducing technology into the teaching and learning process one with neutral impact? To what extent do technology, individuals, organizations, and society interact? An interactive perspective on information technology (Orlikowski, 1992), recognises that technology is not separate and distinct from society and culture. We often fail to appreciate that the systems we create with software are merely subsystems within a wider nexus of overarching social systems. Software based systems merely represent a set of cultural patterns frozen for now into a reproducible and constraining form. Likewise from a systems view of education, we see again a set of educational subsystems operating within the overarching set of social systems of the culture in which the education is taking place. So the education of Christians, Jews, Hindus, Muslims is very different, representing their different cultures and religious heritages. The education of those within traditional indigenous cultures is different again, with the primacy of oral as opposed to written communication being asserted, and the emphasis placed upon collective rather than individual achievement, community and kinship ties and one's place within the tribe.

4.2 The Concept of a Discourse

One way of relating these contesting values to higher education and e-learning is through the concept of a "discourse". A discourse operates as a mechanism in society to define social interaction, prescribe certain rules for that interaction, specify the boundaries of what can be said in a given context and "prescribe which actors within that discourse may legitimately speak or act" (Davies & Mitchell, 1994). In society we could be said to inhabit "discourse webs" in which different cultural perceptions and agendas are advanced. It is like a contest between different stories, either jousting to be told, or to define the rules dictating which stories are permitted to be told.

In the E-Learning environment several discourses contest for space. One key dichotomy for higher education is that between the "discourse of enterprise" and the "discourse of community".

4.3 The Discourse of Enterprise

The discourse of enterprise comes from a neo-liberal interpretation of society, in which the economically rational or self-interested human being is primary.

In the discourse of enterprise humans are defined in a wholly economic frame, with individual lives as an enterprise of the self, like individual businesses engaged in developing their own human capital. The language of the market takes over, and civic culture becomes consumer culture. The citizen is reconceptualized as the sovereign consumer/customer. This discourse, for some time popular with western governments, has now permeated into the areas of social service provision. Patients, parents, passengers and pupils are re-imaged as customers. The power of this discourse is that it links the political, the technological and the ethical by aligning "the politico-ethical objectives of neo-liberal government..., the economic objectives of contemporary business and the self actualizing, self regulating capacities of human subjects" (Du Gay and Salaman, 1992).

Globalisation is part of this same discourse with the enterprise vision of capturing bigger markets, and the use

of technology as a vehicle to deliver services on a global scale. E-Learning aligns well with this discourse and the globalisation agenda. We even see arrangements such as the World Trade Agreement prescribing rules for free trade in educational services, (Bridgeman et al., 1999), so that global barriers to education delivery can be broken down. E-learning if viewed in this context can be seen as one strand in the rise of a new religion, that of *globalisation*, based upon a belief in the value of "free markets" and their ability to deliver global prosperity. The difference here is that the culture being asserted is global western culture, not local and unique forms.

4.3 The Discourse of Community

By contrast the discourse of community asserts the right of citizens to function collectively to maintain and build their communities. As opposed to the single utility model of economic rationalism, we see a concept such as Etzioni's (cited in DeSanctis, 1993), of dual utility both to ourselves and to one another. This discourse has a moral dimension which requires us to make our choices constrained by values such as fairness and justness. The duties we owe one another are emphasised, such as to care for our elderly and educate our young not as isolated individuals but for the wider social good. E-Learning based upon this discourse would not be about grasping bigger markets, but about supporting community building initiatives, and enabling diverse initiatives tailored equitably to the needs of learning communities.

5. Differing Perceptions and the Role of Higher Education

In the *"sovereign consumer"* model the teacher becomes subservient to the students' whims. But a sound higher education teaching and learning model is not one of tailored individual instruction, or the commercially efficient version of *mass customisation* (cf. Mathieson, 1998), where the teacher is ruled by several tyrannies of one. While each individual is unique and must be acknowledged as such, the needs and interests of the group must also be balanced, teaching and learning are social processes, and the role of the teacher is to guard carefully the trust of diverse stakeholders. Against this essentially moral role of the teaching professional, is the dilemma that Hinchcliff (1997) poses: which stakeholders do we serve, are we "educators of students or trainers for industry?" Universities have multiple stakeholders – parents, students, employers and the wider society. "The demands of serving the needs of an industry may conflict with our need to serve educational ideals" (Hinchcliff, 1997.).

Mass customisation in E-Learning while superficially promising to better meet the needs of all learners, does not meet the requirements of a community discourse. This model of education delivery is based upon the discourse of enterprise, on the "education as knowledge transfer" model, and a teleological pedagogy of staged goal-driven units for individuals to complete. The advantage of this model of education is that the learning units can be tidily packaged and the courses "sold" commercially as products, while leveraging economies of scale. However, mass delivery of custom product with self-paced learning options is an individualised instruction model, which devalues group and community learning modes and brings the danger of homogenisation of culture.

There is scope for complementary diversity in the E-Learning space, but if we ignore the community discourse we run the risk of having our culture and communities usurped by the juggernaut corporate models eating inexorably into community space. And let's be honest, in a marketing sense they see an opportunity – in the US the higher education "market" is said (Baer, 2000) to be worth about $230 billion, mostly delivered by community institutions. The training market by contrast is said to be worth $75 billion, and mo stly delivered by the for-profit sector (Baer, 2000).

Higher learning cannot afford to ignore this discourse. Dennis Tsichritzis (1999) in as significant an academic journal as Communications of the ACM has asserted vigorously, "today's university is at a turning point, and turn it must. The time has come to recognize that education is a business and students are the customers". Regarding the role of the University teacher he further asserts that "professors are personnel who produce and evolve content". Harris (2000) in contrast to this view refers to "the threat to the traditions of scholarly enquiry within the academy".

A model of education in which education is a transformative process for the student is hugely at odds with Tsichritz's construction of the student's or the professor's role. Sound pedagogy informing teaching and learning is not about students as passive customers, but as active participants in a process of personal and social change and enquiry. The educator's role is not to simply provide content but to structure the learning opportunities for students, and as far as possible to engage them in that process.
The several roles of the University must also be acknowledged, among which may be numbered: to generate critical thinkers, to contribute to the creation of new knowledge, to offer equitable access to those able to take advantage of higher learning, to develop capable and adaptable citizens ready for the demands of an uncertain future world, to develop the potential of learners, to serve as a critic and conscience of society.
These goals will not be readily met by a commercial model, and will often be quite at odds with commercial goals. Generating docile labour units to participate in today's jobs, while happily paying for the privilege, will do little to address the broader needs of society.

6. E-Lemmings?

However there are some signs in early E-Learning venture failures that the core competencies that are required in the higher education sector are very different from those in the commercial training sector. Poorly implemented educational solutions, with weak business models have led several providers to collapse, or revise their strategies (Parkinson, 2000). Courses designed with restricted and wooden objectivist pedagogies, based upon mass delivery of packaged content are unlikely to enthuse many students. Low completion rates and the challenges of motivating distance learners are well known factors in traditional distance learning, why should they differ in online environments?
However "the naïve technological progressivism" (Harris, 2000) which has led many University administrators to join in virtual University consortia, purchase learning management systems, grandly pronounce e-learning strategies, appears to offer little more hope from the University sector.

7. Conclusion

While many may be rushing headlong to disaster, the Open University (OU) in the UK is one example of a successful Mega University, where the scale of activity has enabled significant reductions in the cost of servicing each student. Costs have been quoted as "less than $400 per student compared to over $10,000 in the UK and USA" (Harris, 2000). Nevertheless the OU still serves the greater social purpose of a University being research-led in its teaching and learning activity, and enabling significant access to higher education from groups formerly excluded. While the OU as a networked bureaucracy (Harris, 2000), has the expertise in both education and distance learning to adjust to a move towards greater online provision, this will prove a far greater challenge for other institutions, who lack the economies of scale, the reputational strengths or the expertise to succeed with such an educational model.
My own view is that most institutions can most productively experiment with hybrid delivery models – partly online, partly web-supported, using what Harris (2000) terms an "interstitial model" involving "investment in new learning technologies combined with conventional methods". There remain nonetheless real concerns about the "moves towards cartelization and learning consortia, many of whom operate on a multinational basis. Homogenization of learning content is a risk in these developments" (Harris, 2000).
Baer (2000) proposes several ways in which the academic and for profit sectors may productively collaborate, and these approaches may help preserve the best of public education while meeting some of the commercial pressures towards profitability and growth in market share. The broader role of the public institutions must be acknowledged and preserved, while we search for appropriate pedagogical combinations and effective ways to use the new technologies to meet the increasingly diverse needs of learners.
In the end maybe we can find effective accommodations where communities can provide customised, unique and local forms of education to meet their own needs, augmented by links to other online learning communities and resources in ways which enhance diversity and build local communities rather than create bored captives to globally delivered cheap product creating monoculture online.

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Tools to Foster Course and Content Reuse in Online Instructional Systems

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Abstract: A significant issue for the success of an e-learning system is making course creation and maintenance cost-effective. The creation of electronic course content has historically been extremely expensive and time-consuming (Klingenstein, 1998; O'Donnell, 1999). One way to make online course delivery less expensive is to avoid starting over every time new courses and instructional materials are needed. The creation of reusable course content is one way to break out of the cycle of recreating instructional materials from scratch. This paper contains a description of LEO – a Learning Environment Organizer. The use of LEO plays two helpful roles in fostering the reuse of existing course specifications and instructional content. It fosters the creation of course templates that can be tailored to specific audiences and that foster reuse of instructional content. It also provides an automated means of cataloguing content that has been used. This cataloguing facilitates identification of content in order to foster its reuse.

Introduction

The Internet is revolutionizing the delivery of education and training with the introduction of on-line, e-learning systems. With the rapid evolution of the Internet as a delivery system comes an increased focus on the need to make highly flexible, tailorable training and education program creation and maintenance simpler. These tasks have historically been expensive and time-consuming (Klingenstein, 1998; O'Donnell, 1999). One way to make e-learning content development less expensive is to avoid starting over every time new materials are needed. The creation and cataloguing of reusable course content modules is one way to break out of the cycle of recreating instructional materials from scratch. The goal of fostering reusability of course content gives rise to two major issues:

- cataloguing and identifying potentially useful materials, and
- being able to reorganize entire courses, topics, and content simply and easily.

It is time-consuming to produce content itself, and even more time is required to catalogue the completed product. At present, no universal standards exist regarding how to catalogue data. Groups such as the Dublin Core Metadata Initiative (Dublin Core, 2001) are attempting to develop interoperable online metadata standards that support a broad range of purposes. International standards are emerging within individual disciplines, as in the case of ISO/DIS19115, an international standard for geographic data (ANZLIC, 2000). Other organizations such as the Advanced Distributed Learning Initiative (ADL, 2000) have established their own standards for documents to describe on-line instructional content. Currently, ADL has created standards in conjunction with the IMS Global Learning Consortium (IMS, 2001) to catalogue entire courses, topics within courses, and individual pieces of instructional content. As the products of these initiatives are deployed, they will ultimately make possible searches that return fewer spurious matches than are produced by current search engines and strategies.

Assuming that content has been created and identified, it can still be time consuming to identify reusable subsets of the content and to reorganize them for special purposes or audiences. A system of hyperlinked Web pages could require the editing of links in all the pages to reuse the content. A better way to foster reuse would be to have an organizing component that presents course templates that can be easily rearranged and that can tie appropriate instructional materials together in varying combinations in order the reuse the material.

This paper contains a description of a demonstration software program named LEO, a Learning Environment Organizer, that provides a graphical editor used to create, edit, and archive course layouts that provide structure to course content. LEO may be used to produce reusable organizers that can be rearranged to meet the needs of various audiences. LEO also supports the flexible reuse of content that may be assembled in various combinations, as well as the generation of metadata records for content that has been used. This paper presents a

basic description of LEO and a description of how this software fosters reorganization of courses and topics for reuse of instructional content. The paper also describes how LEO can be used to catalogue instructional materials.

LEO: A Learning Environment Organizer

This section describes a Learning Environment Organizer (Coffey, 2000) that is part of a distributed knowledge modeling system named "CMapTools" (Cañas, et al., 1998; Coffey, 1995; Ford et al., 1996). An Organizer is a graph that takes the form of a modified concept map (Novak & Gowin, 1984) with two different types of nodes: instructional topic nodes that correspond to the topics in the course, and explanation nodes that explain about the topics. Figure 1 presents a view of an organizer pertaining to the computer science course named Data Structures.

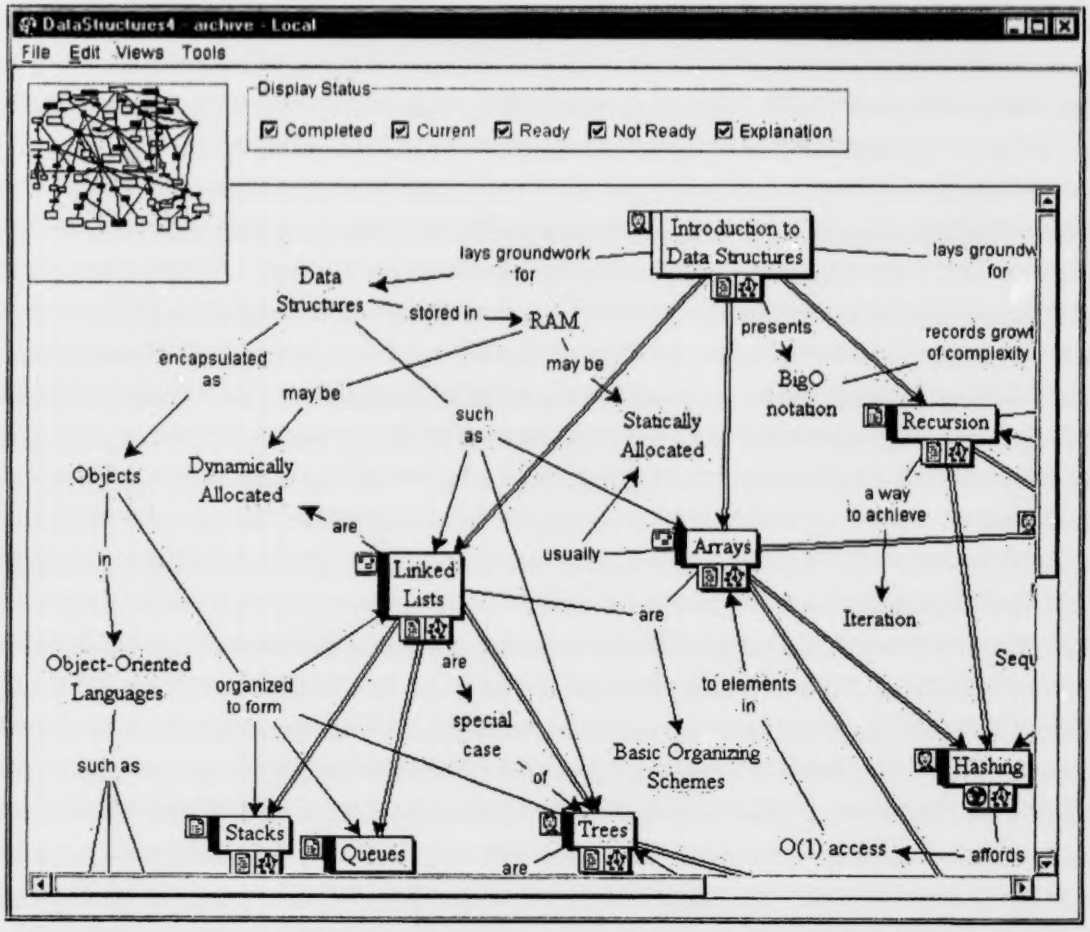

Figure 1. A typical organizer, showing place and explanation nodes.

As can be seen in Figure 1, the organizer presents a context and focus view of the course organization. The context view is the small square box in the upper left that contains a view of the entire organizer, and the focus is the large, readable area that fills most of the window. The smaller rectangle that appears in the context view can be dragged around that view in order to scroll the focus along arbitrary trajectories. The display status panel in the top-center of the window allows subsets of the focus view to be either shown or hidden.

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Topic and explanation nodes are visible in the focus view. Topic nodes correspond to the topics in the course. Figure 1 depicts topic nodes as those surrounded with shadowed boxes, populated with icons, and containing a rectangle that color-codes the status of the topic. Explanation nodes elaborate the relationships among the topic nodes and have no adornments. For example, "Introduction to Data Structures," "Linked Lists," "Arrays," and "Recursion" are topic nodes, whereas "Data Structures," "RAM," and "Statically Allocated" are explanation nodes.

Double lines that indicate prerequisite relationships connect the topic nodes. They are hyperlinked (as indicated by the icons beneath them) to the instructional content that can be used to study the topic under consideration, and to media that describe the tasks, activities, or completion requirements associated with the topic. When the user clicks on the icon beneath a topic, a pull-down menu appears that presents choices of links to online instructional content or to the tasks, assignments, activities, etc. that are associated with the selected topic.

Reusing Course Descriptions and Course Content

LEO fosters the reuse of both course descriptions and course content. The editor provides capability to create, edit, sequence, or delete entire course descriptions, or individual topics within a course. It is also simple to select media that will serve as content for a course and to associate it with the topics. LEO's incorporation into CMapTools allows knowledge models to be used as course content. LEO allows different subsets of a CMapTools model to be organized into a course with a specific goal. Once content has been imported into CMapTools (which an be done with a simple drag-and-drop operation), it is available to be linked to a topic or explanation node in LEO.

The editor is a modeless drawing tool with a variety of capabilities. The editor allows the user to create topic and explanation nodes, to create arcs between the nodes, and to place linking phrases on any of the arcs. It also allows the developer to browse through local or remote content and to create hyperlinks between topic or explanatory nodes and content that has been identified. The editor provides the capability to select completion criteria and to associate the criteria with a topic. The software is easy to use because the user does not have to switch between modes to perform these various operations. Within an existing course description, it is possible to create, edit or delete individual topics. It is also possible to change a topic into an explanatory node or an explanation node into a topic. The editor provides functionality to add or delete links between topic and explanatory nodes and to change the names of the nodes and linking phrases themselves. The layout of the entire graph may be re-arranged using standard drawing package functionality that permits the selection and relocation of one or more items.

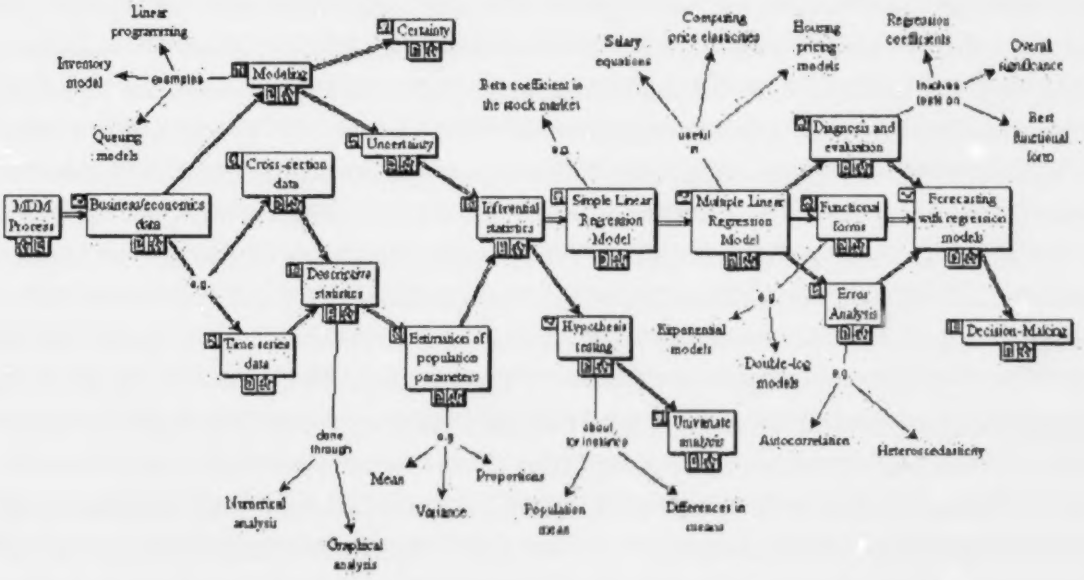

Figure 2. An organizer for a course on Regression Analysis

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Figure 2 presents an example of a course on regression models for decision-making. This course starts with an introductory topic (on the left-hand side of Figure 2) that is followed by the topic "Business and Economic data." In turn, that topic is followed by several topics on modeling, two types of data, and "Descriptive statistics." Following these introductory topics, the course progresses through a series of topics on various regression models, leading to a discussion of how to make decisions based on the forecasts that these models provide. The links to content are indicated by the icons beneath the topics.

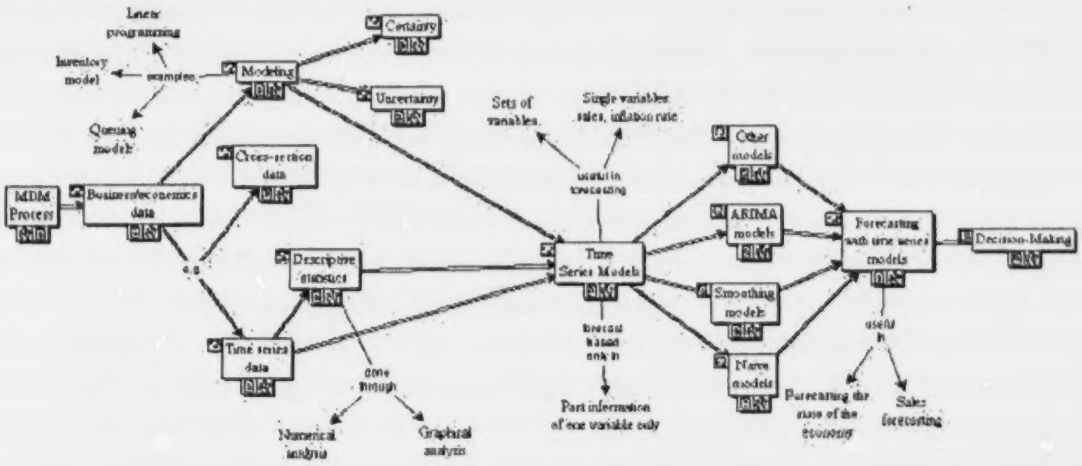
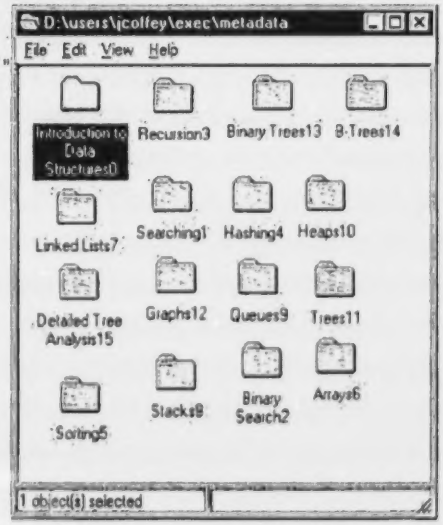


Figure 3. An organizer for a Time Series course that reuses content from the Regression Analysis course.

Figure 3 presents an organizer for a course in time series models. This course utilizes some of the same introductory material as the course presented in Figure 2, in particular, topics covering modeling, types of data, and descriptive statistics. The starting point for development of the course presented in Figure 3 was the introductory material from the course depicted in Figure 2. The topics and explanations on time series models that are specific to this course were added to the general introductory material. The links to content for the topics that were reused were already established and retained.

```
<?xml version="1.1" encoding="UTF-8"?>
<!DOCTYPE record SYSTEM "IMS_METADATAAv1p1.dtd">
<record xmlns = "http://www.cs.uwf.edu/jcoffey/metadata/"
  <metametadata>
    <metadatascheme>
      ADL SCORM 1.1
    </metadatascheme>
  </metametadata>
  <general>
    <title>
      <langstring>Introduction to Data
                  Structures</langstring>
    </title>
  </general>
  <description>
    *****Place description here********
  </description>
    <keywords>
       <langstring>Static structures</langstring>
    </keywords>
    <keywords>
       <langstring>Dynamic Structures</langstring>
    </keywords>
    . . .
</record>
```



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Instructional content could be added to or deleted from any of the reused topics by selecting the topic and choosing to edit the resources associated with the topic. This form of organizer facilitates recombining previously created content. Figure 4a. Metadata Record. Figure 4b. The Metadata Folders. variety of media exist on a topic, these media can be included in varying combinations, depending on the audience. If a course on a different subset of a domain is desired, explanatory items can easily be made into topics and topics can be made into part of the explanatory component.

Cataloguing Content for Reuse

LEO provides capabilities to create metadata records for the entire course and to scan through the list of course topics, creating records for them as well. Figure 4a presents a part of the metadata record for the first topic in the Data Structures and Algorithms course presented in Figure 1. This metadata record is structured according to the format described in the ADL/IMS specification, as presented in the Sharable Content Object Reference Model (SCORM) (Dodds, 2001). Although the current demonstration software has been coded specifically to produce metadata records that comply with the ADL/IMS format, future work will lead to the creation of a code generator generator (Glanville & Graham, 1978; Henry & Damron, 1989) that will automate the creation of a metadata record generator from a BNF or other context-free grammar description of the requisite format.

As the metadata records for individual topics are being created, the links to course content are read, and metadata records for the content are created. The course metadata record is placed in a subdirectory that contains all the metadata for the course. A subdirectory within that directory is created for each of the topics in the course, and a topic metadata record is placed in the subdirectory. The metadata records for the individual course content items that are linked to the topic are placed in the subdirectory for that topic. Figure 4b illustrates the directory structure that is created for the metadata records associated with the Data Structures course.

The metadata records contain a variety of information that can be automatically determined from the system. The names of the course, topics, and individual media are taken from the filename of the course organizer, the topic labels in the organizer, and the names of the media that are used in the link to the content. When individual media is imported into the system, the media can be annotated with a description that can be used in the metadata record. The metadata generator software uses that description or prompts for one if none exists. The generator reads the directory entry for the file to determine the creation date of the file. The software provides editable default values for copyright status and placeholders for keywords that might be associated with the media, topic, or course. These values may be edited at any time.

Summary and Discussion

This paper contains a description of a demonstration software program entitled LEO. This program contains an editor that can be used to create modifiable courseware description templates. A depiction of the course layout is created as an annotated graphical representation. Metadata records describing the course, the topics in the course, and the content associated with the topics can be automatically generated from this graphical depiction. This capability has been demonstrated with the addition of the capability to generate automatically ADL/IMS compliant metadata descriptions. In this way, LEO makes it possible to catalogue and reuse content, and to archive and update course descriptions for presentation to various audiences.

The editor provides for point-and-click selection or substitution of content, topics and their sequences, for the specification of completion requirements, and for the automatic generation of the metadata records. The software also provides capabilities for the automatic creation of metadata records for content that has not previously been catalogued when that content is included in a course organized with LEO. The structuring of subdirectories containing metadata records and the capture of a global path to those directories make their placement on a server of choice simple. As standards emerge for the cataloguing of data in various domains, these capabilities will make it possible to do more accurately targeted searches for requisite educational content based upon metadata records of the sort that can be generated with this software.

Future work will involve adding a program generator to the system that will take a format description in a context-free grammar, process the rules, and automatically generate a module that will translate the graphical representation into the specified grammar. The value of this capability is seen specifically in its application to the generation of potentially rapidly evolving courseware descriptions of the sort described here, and more generally for

the automatic creation of a translator to produce descriptions of any sort of annotated linear, tree-like, or graph-like structure.

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Living Science On-Line

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I. Project Summary

Through advanced web-based technology, Indian River Community College (IRCC) is bringing "living science" to teachers and students interested in science. Research scientists from Smithsonian Marine Station, U.S. Department of Agriculture, Harbor Branch Oceanographic Institution, and other Treasure Coast research facilities interact with IRCC faculty and with area high-school and middle-school math and science teachers in specialized training programs to improve science and math education. These local research scientists also are working with college faculty from IRCC and local science and math teachers to create a web-based "Scientific Community."

The Scientific Community serves as a resource for teachers, students, and professional scientists. It creates a web site that contains information on scientific experiments or other scientific information that assists science and mathematics educators and students. In addition, advanced distance learning technology has been used to offer science and mathematics courses to students through an innovative approach that brings the scientists to the students and the students to the scientists electronically.

This presentation will describe the unique characteristics of this program, will discuss the on-going developmental process for the on-line Scientific Community, and will display innovative on-line course delivery systems used in the Introduction to Ecology course.

II. Project Description

Indian River Community College (IRCC), through an Earmark Appropriation from the U.S. government, is working to increase student interest in science using advanced web technology to bring "living science" into classrooms and homes. Through web-based technology, IRCC provides the opportunity for teachers and students interested in science to interact with science professionals. Research scientists from Smithsonian Marine Station, U.S. Department of Agriculture, Harbor Branch Oceanographic Institution, University of Florida Institute of Food and Agricultural Sciences, and other Treasure Coast research facilities interact with IRCC faculty and with area high-school and middle-school math and science teachers in specialized training programs to improve science and math education. These local research scientists also are working with college faculty from IRCC and local science and math teachers to create a web-based "Scientific Community."

The Scientific Community serves as a resource for teachers, students, and professional scientists. It creates a web site that contains information on scientific experiments or other scientific information that assists science and mathematics educators and students.

We recognize that the best content providers are the very teachers who will use the Living Science Program's web site as a resource for teaching materials, information, and fresh ideas. The teachers know what types of materials and information are needed and what will be useful in the classroom. They also can provide classroom-tested materials and activities. To assist their learning, students have access to the majority of the educational content developed.

Science and math teachers from Treasure Coast middle schools and high schools submit project proposals for the content that they would like to contribute to the web site in three broad disciplines: physical sciences, biological and marine sciences, and mathematics. An appropriate IRCC faculty member supervises each discipline.

Projects range widely in their content. The most common types of projects are detailed lesson plans, activities and problem sets designed for classroom use. Such lesson plans provide beginning teachers with valuable resources from which to build their own courses and provide more experienced teachers with fresh ideas for teaching. The lesson plans contain sufficient

background information to familiarize teachers with the topics, classroom activities, worksheets, exam questions and answers, and appropriate Internet links.

Other projects include:
1) science- and math-oriented games and crossword puzzles,
2) potential science fair projects for students,
3) detailed instructions for submitting a science fair project,
4) raw data and summaries of student research projects,
5) a student written online magazine covering human biology and health issues, and
6) online interactive lessons in mathematics, chemistry, and biology.

In addition to development of the Scientific Community web site as a resource, we also used advanced distance learning technology to offer physical and biological science courses and mathematics courses to students through an innovative approach that brings the scientists to the students and the students to the scientists electronically.

The Internet offering of "Introduction to Ecology" is an example of the type of course developed as part of Indian River Community College's Living Science Program. The Internet Ecology program employs several unique and innovative techniques to reach out to the distant student. In addition to providing the typical reading assignments, on-line testing, and instructor contact over the Internet, Internet Ecology attempts to overcome some of the difficulties of distance learning by providing on-line mini-lectures that are downloaded through the Internet via streaming video. These mini-lectures help students identify and understand the major topics typically addressed in an ecology course

The mini-lectures are designed as overviews of each chapter. They are also used to discuss important aspects of ecology not adequately covered in the text, and to provide a different perspective from that of the text's authors. The mini-lectures also create a more personal relationship between the instructor and students, in essence, taking the classroom to the students. Students can ask questions asynchronously of the instructor via e-mail or the on-line bulletin board provided by the course software, WebCT. This method of on-line instruction appeals to students who respond positively either to visual or to auditory stimuli.

Sixteen 10-18 minute streaming video lectures have been produced covering 24 text chapters. Each mini-lecture was developed using PowerPoint to provide visual information which include many of the instructor's own photographic images, public-domain images downloaded from the Internet, and text notes to highlight important concepts. The instructor conceived, wrote, recorded and coordinated the audio and visual portions of the mini-lectures. The Distance Learning Department assisted with the audio recordings using Sound Forge. Distance Learning personnel overlaid audio recordings on the PowerPoint visual presentations using Flash. On-line students access the mini-lectures through WebCT and view the mini-lectures using a free RealPlayer viewer on their own computers. The PowerPoint file, with images and text is also viewable without RealPlayer through the course web site as a student study guide and review.

In addition to the mini-lectures, streaming video clips of a variety of research topics are also available to the Ecology students. The Research Summary videos are designed to communicate to students how scientists actually conduct science in the laboratory and the field. The focus on local research projects is meant to emphasize the local relevance of science and ecology to students. The Summaries also provide scientists with an avenue to engage students, communicating the excitement of discovery and the process of science to potential future scientists and voters.

These short 5-10 minute video productions feature scientific researchers from the Treasure Coast area talking about their own work and the excitement it brings them. The Research Summaries are similar in format to the course mini-lectures except they also include video clips, so students can view the researchers in action. Current videos include research material from scientists at the USDA Horticultural Research Laboratory in Ft. Pierce and other researchers at the Harbor Branch Oceanographic Institute, the Bureau of State Parks, and Florida Atlantic University.

The Research Summary videos contribute to our expanding on-line library of streaming videos that is accessible through IRCC's Scientific Community, the Living Science web site. This web site provides area teachers and students with state-of-the-art resources to improve science education on the Treasure Coast. The purpose is to enhance the learning experience of distance learning students taking a non-major's Ecology course such that they successfully complete the course.

Partners in the Living Science program include IRCC; Florida school districts in Indian River, Martin, Okeechobee and St. Lucie counties; and the scientific research facilities of the Smithsonian Marine Station, Perry Institute/Caribbean Marine Research Center, Florida Oceanographic Research Society, US Department of Agriculture Research Laboratory, Harbor

Branch Oceanographic Institution, Florida Atlantic University School of Marine Science, and University of Florida Institute of Food and Agricultural Sciences.
The Living Science Program addresses several needs identified by these partners.

Training programs for Treasure Coast teachers provide interaction with professional researchers and educators. Internet courses in general, including Introduction to Ecology, provide equal access to a quality-learning environment to all IRCC traditional and dual-enrollment students through electronic delivery. The inclusion of mini-lectures further enhances the experience of more visual and auditory learners than is normally available in the on-line format. The finished Research Summary is in partnership with the local scientific community. The research addresses agricultural, economic and natural history topics that are an important part of Treasure Coast culture. The Research Summary currently available is the beginning of a library of such summaries that will be used for Internet Ecology and also made available to the Living Science Program's community of students, educators and scientists.

Learning in the Palm of Your Hand

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Abstract: The contributions of the National Classroom Project are based on the author's extensive experience with a web-based testing environment for college classes and the development of K-12 learning applications for Palm hand-held computers. The paper describes the technology developed by the author and discusses the lessons learned in the classroom.

Introduction

Can technology have a fundamental impact on human learning? Not just making teachers more efficient or off-loading manual tasks like grading, but actually saving those children whom the "system" currently loses. Are we on the threshold of a revolution in education in which the goals are to instill a love of learning and then to guide each student through an individual voyage of discovery?

The National Classroom Project (NCP) [1,2] is attempting to explore the answers to those questions from the perspective of a technologist, who is not a trained education professional. Thus, the focus of the Project's research is creating learning applications. We use some of the applications on a regular basis for college courses in a Department of Computer and Information Science. Other applications have been developed for use as enrichment activities in grades K-12 in the local school systems (public and private). Students use Palm computers (currently Palm IIIs or Handspring Visors) or a web browser.

Originally, the project was based on the assumption that network connectivity would be pervasive using wireless technology, such as Bluetooth or IEEE 802.11b, which turned out to be a reasonable assumption for the college environment. Thus, the first part of the paper discusses our experiences with network-based learning services. However, in trying to implement this model in the local school systems, we discovered that off-site access to our servers was not reliable.

As a result for K-12, we are investigating a model in which students intermittently "sync" to their teachers PC, which serves as a control station to monitor students' progress and to distribute activities. The second part of the paper discusses our experiences with this model in K-12 classrooms.

Web Testing

The web-testing server gives tests, which are taken using a web browser, and then grades them. It is implemented using the author's object-relational database system [3]. The system was first used to give tests to computer science students. The students were given several days to complete each test. Basically, each student entered a user name and password and a test id. Then they would be given the test questions as part of a web page form. Upon completion, the student would select the SUBMIT button to execute the grading program at the server. The system has now been in use for several years. Some of the courses include Computer Organization, Operating Systems, C++ and Java Programming. The students really liked being able to take the tests at their convenience and the absence of the time pressures of an in-class exam. The disadvantages included technical problems (i.e. ISP disconnect) and the lack of help if there were questions about the questions.

The system supports the ability to set both the start time and the stop time for each test. It also records the time at which each student retrieves and submits his test. For example, tests due at 9am tended to have a cluster of activity around midnight and an even bigger cluster in the hours preceding the deadline. We use the testing system to give out-of-class exams because that generates additional lecture time. Of course, having out-

of-class exams raise the challenge of cheating prevention. We address this issue by guaranteeing that each exam is unique. Thus, copying as a cheating technique is eliminated. Two students can still cheat, but one of them has to complete two exams!

The question format is tabular so that questions can be stored in a database system. We believe that in the future it will be desirable to select questions by executing queries that are conditioned on a student's past performance and other criteria. The NCP testing system supports embedded HTML within questions so that there is considerable flexibility in formatting. Further, test generation can involve the permutation of the answers for each test and the random selection of questions from test bank sets. Random question generation does raise the issue of accountability. Students like to know why they missed a question. Thus, the system has to record the id of the question that was asked as well as the correct answer and the student's answer.

Parameterized questions make it much easier to generate tests that can be altered to accommodate different skill levels among the students. Having parameterized questions created an opportunity to enhance learning by making practice tests available to the students. The answers are hidden in a drop-down control so that a student can first fill in their answer and then check it against the correct choice. The response from students with respect to the practice tests has been very positive.

Palm Applications

As mentioned earlier, we were never successful in trying to set up an ad hoc laboratory of networked computers in K-12 classrooms. As a result, we scaled back our solution to one that was technically and economically feasible for local schools. The K-12 NCP laboratory is a small suitcase of Palm computers, a small Canon IR printer, and an IBM ThinkPad laptop with a USB synchronization cradle. The learning applications are distributed either by syncing with the laptop or by having the students "beam" the applications to each other. Students of all ages get excited about beaming data back and forth.

We have developed a simple scripting language, EduScript, which has been used to code the various applications. The language supports the basic data types and provides interfaces to the functions of PalmOS. Figure 1 illustrates some sample EduScript applications.

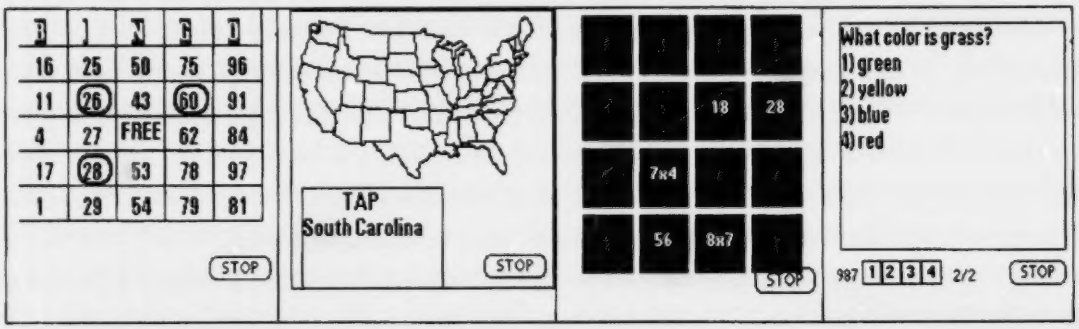

Figure 1. Sample Palm EduScript Applications

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E-Learning – A Collaborative Model Connecting Students, Teachers and Organizations

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Abstract: This paper outlines a collaborative e-learning model that has been developed to connect students, teachers and organizations in the learning outcomes of stage three courses in a Bachelor of Business Management Degree. The model adopts a broad approach to e-learning principles and comprises four components that contribute to the learning experience. They are "Business 2 Education", and "Education 2 Business" initiatives, a flexible learning environment, integrated assessment practices using a threaded live case study, and mentoring and student supervision. The paper concludes with a critique of the model from the perspective of the various stakeholders with comment on future directions.

Introduction

Background

The Christchurch College of Education has a tradition of tertiary education that spans almost 125 years. During that time it's main focus has been teacher education and professional development for teachers. In the past ten years however, the institution has broadened and diversified, and now offers qualifications in Performing Arts, Sports Coaching and Business.

The School of Business at the Christchurch College of Education was established in 1991 and initially offered diploma level business qualifications with an applied focus. The New Zealand Qualifications Authority in its Regulations and Prescription Handbook (2001), provides a graduate profile that describes the nature of an applied diploma as developing graduates who will demonstrate "the ability to apply a broad range of generic business skills, principles and practices" as well as having "the ability to apply technical knowledge and skills particular to specific business fields". This has provided the context for qualifications offered within the school.

In 1996 the College affiliated with Griffith University Australia, an institution with a similar reputation for innovation, and a willingness to embrace new approaches to teaching and learning. Griffith University (2001) describe themselves as providing "degrees that are strategically focused for our particular time and place - degrees that lead to the careers of today and tomorrow". This common emphasis on offering current and relevant qualifications presented an apparent fit between the two institutions.

A major initiative of this partnership was to develop a Bachelor of Business Management Degree to be jointly conferred by the Christchurch College of Education and Griffith University. This makes the qualification a trans-tasman qualification with significant advantages to students. Study options are available within New Zealand and

Australia, and on graduation, employment opportunities are enhanced as the qualification is recognized in both the New Zealand and Australian labor markets.

The Bachelor of Business Management

The Bachelor of Business Management is a 3-year under graduate degree program. As an applied business degree it is a significant movement away from the more traditional, theoretical degree program. It has an emphasis on:

- Giving students an applied business experience, including workplace internships, while presenting current and relevant theory and research.
- Delivery to relatively small groups, emphasizing inquiry, communication and teamwork.
- Providing web-based materials for courses to support learning. (School of Business Prospectus, 2001, p.16)

In-order to achieve these outcomes experiential learning and live case studies are employed throughout the teaching of the Bachelor of Business Management. This includes a variety of real life case studies and guided practical work with organizations' actual business issues.

Within the Bachelor of Business Management, students will identify a subject major from the fields of:

- Business Communication
- Employment Relations
- Enterprise Management
- Information Systems
- Managerial Accounting
- Marketing

Flexibility within the degree structure allows a student to complete a double major, by filling their elective courses with those that satisfy another major. Students must also complete a compulsory element within their degree. Figure 1 illustrates the current structure.

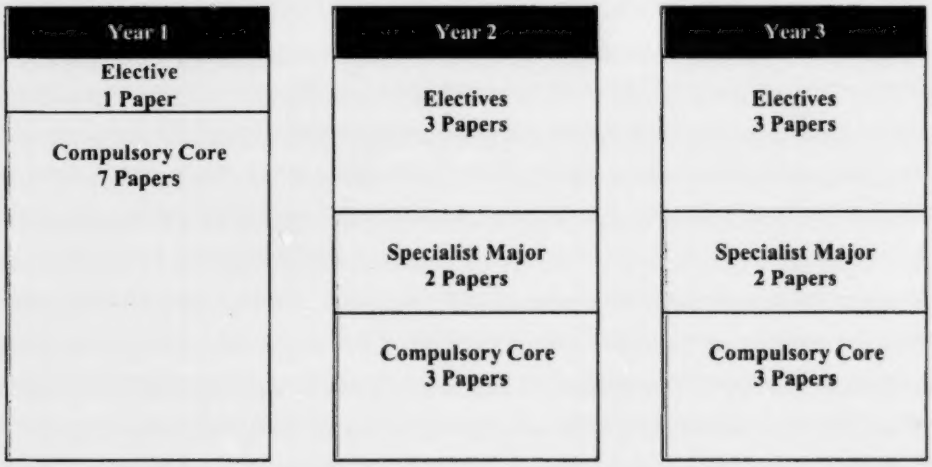

Figure 1: Bachelor of Business Management Degree Structure

Threaded Live Case Study

Waguespack (1997) describes the difference between a live case study and a threaded live case study. He sees both of these approaches as utilizing the "learning by doing" experiential model and states that this "is the most effective pedagogy in preparing IS professionals". The key difference between these two case study approaches lie within the

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question raised by Waguespack. How can students be equipped with broad knowledge principles when the sequencing of learning units in business and information technology may be independent of one another? This is the premise for a threaded live case study, where the case study provides a context surrounding several application problems.

In this paper we discuss how an e-learning model has been designed to provide collaboration and an experiential learning opportunity between two courses. The two courses are Applied Management Project (MGT3001), and E-Business (MGT 3041). These are 3rd year papers for students completing the Bachelor of Business Management Degree.

A core paper, Applied Management Project focuses on the research process with a management perspective. Students work with an organization researching a current issue faced by them and are assessed on the key elements of a research project from an initial research proposal, through to the completion of appropriate research, and finally to a presentation of the research findings to the organization.

E-Business is an optional paper in the Information Systems major. It provides students with the strategies, tools and techniques to analyze new E-Business opportunities, to identify the issues and risks of these opportunities and then manage the expansion process. Students also learn about the development of the dot.com business and the processes required in this development.

To activate the threaded live case study students are permitted to select one case study for which it will be possible to complete the learning outcomes for both of these courses. Figure 2 illustrates how the case study maps to different assessment outcomes for each course.

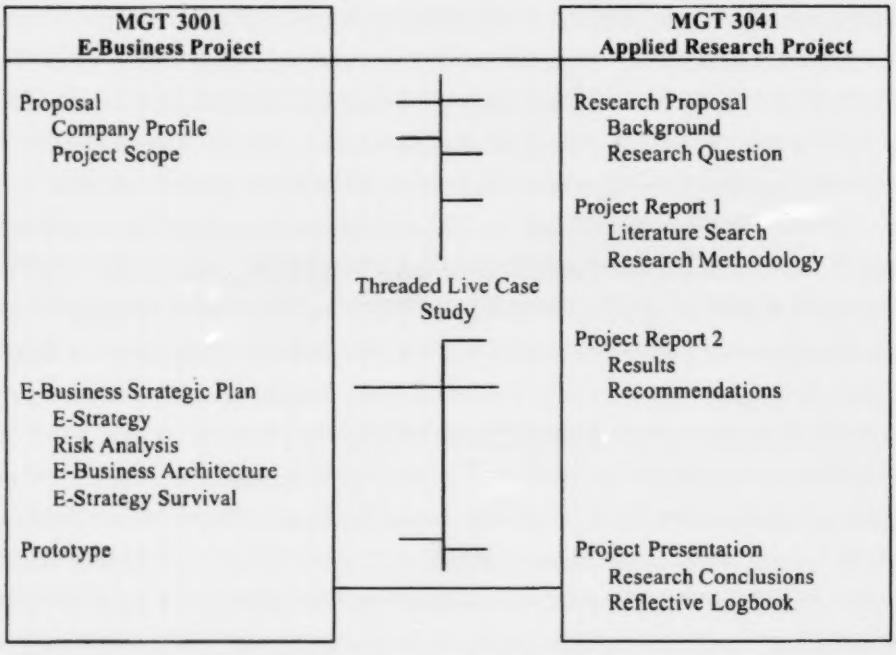

Figure 2: Threaded Live Case Study Assessment Outcomes

A Collaborative E-Learning Model

Rosenberg (2001) argues that "e-learning" is a learning transformation that is poised to take off if it encompasses the following factors:

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- Meaningful and motivational goals that reflect the "real job situation," not merely passing the course.
- Simulations that focus on learning by doing and learning from mistakes.
- Coaching and feedback, preferably from managers and supervisors who are held accountable for the learning process.
- "Expert modeling" and "stories" that reinforce learning.
- Authenticity, which requires continuous revision of training programs to focus on real situations.
- Reuse of the material and links to other sources.

Ismail (2001, cited in Martin 2001) has an equally broad view of e-learning. He says: "Related to the need for learning and e-learning to complement each other is the growing awareness that formal education cannot be separated from informal learning. The domain of learning, therefore, can no longer be confined to formal education institutions".

In the collaborative e-learning model we have developed for the MGT3001 and MGT3041 courses respectively, we have encapsulated these broad e-learning principles to develop an apparently unique approach for the teaching and learning process. The model developed comprises four components. "Business 2 Education" and "Education 2 Business" (B2E / E2B) initiatives, a flexible learning environment, integrated assessment options and mentoring and student supervision.

B2E / E2B

B2E /E2E is an initiative that has been incorporated into our elearning model. This initiative involves direct interaction and involvement in the learning process between our Educational Institution and the Businesses who agree to be the "Live Case Studies" for the students' research and learning. Arnott and Atchison (1997) said that the links between research and practice could be collectively termed "professional engagement". Professional engagement falls into two main categories- teaching by direct instruction, in which student learning is based on teacher centered delivery of the material, and "teaching by doing", where students embrace experiential learning techniques and learn by carrying out activities and reflecting on their experiences.

Bonwell and Eison (1991) and Dabbour (1997) said experiential learning techniques are characterized by: -

- Student involvement in many activities (e.g., discussing, persuading, writing, critiquing) rather than just listening.
- Emphasis on development of student skills rather than information transmission and
- Higher-order thinking on the part of students.

In this case study, as part of the B2B and E2B initiatives, students are required at the start of the course to identify an organization that would be suitable for their research project in MGT 3001 and also for their E-Business Strategic Plan for MGT 3041.

Students were required to spend time working in the selected organization. This provided students with an opportunity to work alongside practitioners, and complete a project where they could apply their learning to real life practice. Research with a strong practical focus provided the students with a great opportunity to explore the adequacy of theoretical models within the context of the constraints that are often imposed in a real world environment.

Flexible Learning Environment

Flexibility was provided so that students could meet the learning objectives of both courses while retaining control as much as possible of "when", "where" and to some extent "how" the learning took place (Janicki and Madey, 1997).
A flexible learning environment was necessary as: -

- Conflicting and other more important priorities often affected timeliness of response by contact people within organizations.
- The case study was a staged learning process and deliverables at the end of the chain could not be completed until research data had been collected and analyzed.
- Constraints and difficulties not anticipated at the outset of the project could arise requiring last minute changes to the "game plan".

Flexibility was provided in a number of ways. Individual assessment arrangements were negotiated with students to fit with their specific case study. In most cases changes were minor, and generally involved re-negotiation of submission dates in response to circumstances relating to the project.

In addition to relaxing deadlines, a web site was provided for both courses. This enabled access to key information by students and supervisors from organizations. Each web site contained a discussion board, notices, frequently asked questions and links to course notes and relevant readings. As students were required to balance commitments between College and the organization, the web site provided an excellent online resource.

Integrated Assessment

The organization case study is a common thread between the MGT3001 and MGT3041 courses. This provides the context for the students learning, however the assessment requirements also needed to be woven. The idea of one case study for two courses had to also work well for the assessment requirements of each individual course in addition to providing a valuable tool for seeing the real life application across more than one academic discipline.

Assessment in the two courses took on an integrated approach where the overall study undertaken by students in the case study allowed different assessment outcomes for each course. Each course had quite specific learning outcomes that were complementary to those within the other course but were not mutually exclusive. Outcomes identified within one course often provided students with a vehicle for working towards further outcomes within the other course.

Example 1: Merrin Street Café and Bar
The first example is a neighborhood café and bar, which is currently a traditional "bricks and mortar" business. Research was undertaken to determine the feasibility to transform the business into an e-business using a staged implementation process. The student was required to undertake primary and secondary research, analyze the findings and prepare recommendations to meet the learning outcomes of MGT3001. The recommendations were presented to stakeholders and formed the basis of the e-business strategy to transform the business and prototype web site that was developed to meet learning outcomes of MGT3041.

Example 2: Institute of Chartered Accountants of New Zealand (ICANZ)
Members of the Public Practice Committee of ICANZ were interested to research the online information requirements of Chartered Accountants with a view to establishing a "Portal" web site with relevant links and services. Learning objectives within MGT3001 required students to complete a literature review that related to the research question they had identified. This provided the students with essential secondary research data, providing a greater understanding of what research had been completed in the area previously and some direction for working towards their research findings. The outcomes from the literature review helped in putting together a research questionnaire to be distributed to Chartered Accountants on the shape and form that an industry related dot com web site should take. As with Example 1, the literature review, research findings and recommendations met the learning outcomes of MGT3001 and the dot.com development strategy and prototype web site met the learning outcomes of MGT3041.

The level of integration in the two examples provides an indication of the careful management required in this approach not only by the student, but also by the lecturing staff and academic supervisors involved in the process.

Mentoring and Student Supervision

In order to be accepted into the Applied Management Project paper, a student must have completed two entry prerequisites, a second-year compulsory paper Management and Decision Making, (MGT2001), and at least two second or third year papers within their specialized major. These prerequisites are designed to ensure students have an adequate understanding of management principles as well as some knowledge of their major, which will be encompassed in their research project.

The Course Examiner oversees all students. Each student will identify a Supervisor at the organization they are working with. This person is a key contact point at the organization. Any resource requirements that may arise through the research process can be directed to this person, while they also provide a medium for discussing the direction the research may be taking. Students will also be assigned an Academic Supervisor within the School of Business. The Academic Supervisor is a subject specialist who has knowledge and experience in the field of research being undertaken. As Doran, Daigle and Robertson (1997) highlight in their overview of mentoring within Computer Information Systems courses, "although a solitary faculty member can be expected to provide guidance for the project a team's project may require technical or domain knowledge unfamiliar to the instructor." Together the Supervisor from the Organization and the Academic Supervisor look to provide the practical and theoretical support to students completing a first time research project. Further the Course Examiner ensures critical research milestones are reached throughout the project.

Critique of the Model

B2E / E2B

The Students Perspective

Students enjoyed the experience of working on a "live case study" within a real organization. In most cases students sourced their own case studies and often had some prior connection or relationship to the organization they were working with. This ensured an interest in the topic and a willingness on the part of the student to do a good job.

The Lecturers Perspective

Convening a course where students are working with a variety of different industry based case studies is both challenging and rewarding. Positive aspects are the enthusiasm that is engendered in the students and satisfaction when outstanding pieces of work are submitted at the end of the semester. The difficulties include trying to match the "wish list" of the organization with student's ability to deliver. Realistic expectations are necessary by all concerned to ensure a happy outcome. Another difficulty is in trying to manage many projects simultaneously while ensuring that dialogue and communication with organizations are appropriate and timely. In some cases, students do not observe standard business etiquette and practice, leaving the lecturer to "pick up the pieces".

The Organization's Perspective

Feedback received from Organization Supervisors has been positive. There was a perception that the input required by them was realistic and not over burdening and the research undertaken was valuable and useful for the organization. Supervisors viewed the process as a "win win" situation with one commenting "in addition to free research, they obtained an excellent opportunity to test a prospective employee before they were employed".

Flexible Learning Environment

The provision of a flexible learning environment is a key component of this collaborative e-learning model. Students are required to be flexible and adapt to the changing needs of the organization that they are working with and therefore need some "latitude" in the College environment in order to mesh everything together.

One case study applied to two courses requires students to juggle deadlines and carefully balance their time between the organization and course work. A key aspect of the flexible learning environment is that students are encouraged regularly, to gage how well things are going and to communicate problems early. A certain amount of sympathy is extended for extenuating circumstances provided they have been communicated prior to assessment deadlines.

The web site as an online resource is beneficial as it makes it easy for students and organization supervisors to access information and allows the lecturer to publish key information in a timely manner.

Integrated Assessment

A student who used one case study across two different courses does not receive an easier road to the completion of each course and was required to meet the same learning outcomes as all other students completing these courses over the same time period. The key difference in terms of assessment for these students was the negotiation of dates for deliverables within the courses. Students using the one case study approach tended to negotiate lengthier periods for completion of assessments thereby disadvantaging themselves nearer the end of the course where assessment workloads tended to get heavier regardless.

Additional effort required to manage the assessment process for a case study spread across two courses takes nothing away from the pedagogical process involved. It is our position that a student can enhance their understanding in one course by supplementing it further with work completed in another. This we believe is an advantage to the students as they can see the various aspects that feed into an issue within business, and it improves the outcomes for the businesses involved.

Mentoring and Student Supervision

The mentoring process has a time cost with Organizational and Academic Supervisors meeting regularly with students to help guide them through their research. To ensure quality outcomes this mentoring role is vital.

Industry feedback on student's research and recommendations has been positive and they have been impressed at what students can actually do and the knowledge they can draw upon.

Future Directions

This collaborative e-learning model was implemented in this format for the first time in Semester One 2001. We have gained considerable knowledge as a result of our experiences and intend to further refine the processes undertaken in Semester Two. We have some concerns regarding "liability" when students are involved in industry based case studies and we intend to seek legal advice to ensure that all our documentation and procedures are adequate.

The component of the model that presented the biggest challenge was integrating the assessment between the two courses and ensuring that the learning experience for the students in each course was not diminished. We considered this particularly important, as both papers are stage three completing papers in the degree. We were satisfied that our objectives were met in Semester One, but plan further refinements to the assessment tools used.

The next stage in the process will be to further promote the applied case study model to the business community. A brochure is to be produced to advertise the benefits of B2E / E2B initiatives. On the B2E side examples will be provided of how business can link in with education providers. For example as members of advisory committees or as guest speakers. On the E2B side what education can provide for business will be outlined including work placements, research projects, just in time training etc.

Future challenges are to adopt the model in other courses where appropriate. We are excited by the future possibilities with collaborative and integrated learning techniques and are keen to explore the opportunities in other stage three papers.

Conclusion

A collaborative e-learning model that involves students applying management principles learnt in class to real life problems faced by organizations leads to a better learning outcome. Student work produced in this setting displayed an ability to analyze a business situation, and find best-fit solutions in "real" but supervised environment.

This model is a further extension of student-centered flexible learning practices that have been incorporated at the Christchurch College of Education over the last decade. The lecturing staff involved in the experience found the broad definition of e-learning to fit well with the philosophy and culture of the Institution.

Many institutions have embraced a narrower definition of e-learning and proceeded to develop online courses with web-based instruction and self-directed learning techniques. The preference at our Institution is not to follow this route. Instead we believe that the best learning outcomes are achieved by offering students a collaborative e-learning environment with applied courses where students are interacting with Teachers and Organizations through threaded live business case studies.

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Ethnographic Approaches in the Design and Implementation of a Web-based Information System

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Abstract In contrast to conventional methods for Information Systems (IS) design, and development, an anthropological/sociological perspective is used through the application of various ethnographic techniques to the information system's development cycle. This methodology is described in the context of a U.S. Department of Agriculture applied research project called REEIS (Research Education & Economic Information System) whose aim is to build the world's most comprehensive web-based information system in the field of agriculture. The focus of the paper is a description of IS development methods that can be associated with an ethnographic design, and the utility, effectiveness and limitations of these methods.

Background

From the fieldwork of Margaret Mead in the 1920s to the study of romance readers in the 1980s, ethnography has emerged as a critical lens in many disciplines, a way of seeing, of knowing. Ethnography is now shaping the way information systems (IS) are designed and documented. In critiquing the use of ethnography for information systems development Blomberg et.al. (1993) write:

> The languages of design and of ethnography evolved in quite different contexts and in relation to different concerns. While the ethnographer is interested in understanding human behavior as it is reflected in the lifeways of diverse communities of people, the designer is interested in designing artifacts that will support the activities of these communities. The current challenge is to develop ways of linking these two undertakings (p.123).

This paper is presented with this challenge in mind and describes the application of ethnography to an information system's development cycle, including eliciting system requirements, and creating a prototype. The methodology was developed as part of an ongoing applied research project that is building ostensibly the world's most comprehensive web-based information system in the field of agriculture. The name of the project is REEIS (Research, Education & Economic Information System) and is commissioned by the Research, Education, Economic (REE) mission area of the U.S. Department of Agriculture. Various phases of the project and its components have been previously reported in the literature and the reader is referred to it rather than being repeated here (Cortez, 1999; Cortez & Kazlauskas, 2000).

Rationale for Ethnography in Information Systems Development

Organizational and social issues associated with the development, implementation and use of computer-based information systems have increasingly attracted the attention of information system researchers' interest in qualitative research methods such as action research, case study research, and ethnography, all of which focus on understanding social phenomena in their natural setting (Drake et.al., 1998).

Ethnography, in particular, is useful in IS research when the focus of the study is participants information behaviors, especially regarding how users capture and process meaning from situations. Potentially ethnographic analysis is able to identify personal sense making that include cognitive, affective and conative (action instinct) elements (Solomon, 1997).

Ethnography derives its impetus from three major schools of interpretative sociology and anthropology (Beyon-Davies, 1997).

1. Symbolic interactionism where the ethnographer takes on the 'role of the other'. In the context of the research reported here, the 'other' is the end-user of REEIS.
2. Phenomenology, as derived from the phenomenological school of sociology, which emphasizes the individual's perception, where the ethnographer attempts to understand the individuals' construction of reality, their definitions, their views of the world.
3. Ethnomethodology that refers to the 'methods' people use in every day affairs to construct their social world, including their interactions with one another, and with the artifacts around them.

The ethnographic research approach is qualitative and interpretive whereby the researcher, cautiously and within certain parameters, interjects a subjective point of view. Good ethnography, in projects such as REEIS, requires more than just 'hanging out' waiting to see what unfolds. The researcher, relying on accepted precepts of the field, and on his or her record of experience, manages the collection of data from a particular perspective determining what data are needed for analysis, where to look for them, and how best to obtain these data from relevant sources. This practice is rooted in good fieldwork where the ethnographic records are formulated by finding out what is significant, then targeting one's observations to all that is around the object of significance, including documents (memos, minutes of meetings, reports, policy statements, etc.) and artifacts (equipment, furniture, physical layout, etc.). In the REEIS project part of the formulation of these ethnographic records was also guided by the use of basic precepts found in library and information science (LIS), organizational behavior, and open systems theory literatures, see [Table 1].

Precepts from LIS Literature	Precepts from Organizational Behavior and Open Systems Theory Literature
1) People avoid information overload by using information channels because they are convenient and accessible rather than because they are high quality.	6) What is included within an organization's boundary and its relevant environment varies from organization to organization on the basis of the nature of the organization's goals, its internal structure, and relationships with other organizations.
2) Most people prefer "talk" channels to publications and electronic databases for this reason.	7) Internal structure enables the organization to cope with uncertainty; the more the organization interacts the stronger the internal structure, and the better it is able to deal with uncertainty.
3) When people turn to recorded sources of information, they tend to prefer ones they already know and are comfortable with, rather than those that require new learning. This hold for learned professional, as well as the lay public.	8) Changes in organizations often result from changes in the organization's environment so that "openness to its environment facilitates an organization's innovativeness".
4) Because of the voluminous amount of information available, it can be said that most people are unaware of what they don't know.	9) One impetus for innovation in organizations is provided by "performance gaps"—discrepancies between an organization's expectations and its actual performance.
5) The mere presence of new information system capabilities does not guarantee use.	10) There is a correlation between the diversity of information gathering, analysis, and distribution activities, and the richness and diversity of information services an organization can offer.

Table 1: Precepts for the REEIS Project

Writers representing these precepts, and associated concepts, in their work include, Dervin (1977), Belkin (1980), Blair (1990), Taylor (1991), Kuhlthau (1993), Katz and Kahn (1966), Zaltman (1973), Churchman (1971), Kanter (1988), Schon (1971), and McGuire, et. al. (1996). These precepts not only guided the direction for data collection, but from an ethnographic perspective, also informed the process for organizing and presenting data.

Ethnography in Relation to Activity Theory and Joint Application Design

It was the intention of the researchers to arrive at a system design that would be driven by behavioral models so as to understand the individuals in the particular context of their work, organizational culture, and very importantly, in the context of the REEIS development project. The procedure for turning the initial set of the REEIS system requirements

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was based on an "activity theory" model that has ethnomethodological elements. Activity theory models link individual human acts with all of their influencing factors in a given environment. The model that was adopted in the REEIS project is called Joint Application Design or JAD, and like other activity theory models has been used successfully in studies relating to human-computer interaction. The objective of the model is to understand the intersection between an activity and the consciousness of the individual engaged in that activity. It considers all social/cultural aspects of the intersection, and very importantly the unique meaning that a subject (individual) brings to an object (goal). The matrix surrounding the activity also involves the use of artifacts. These artifacts may be physical tools or sign systems such as language. As applied to this project REEIS is considered as the artifact, and its value is revealed with each of its use. The value depends on the intention of the user and the resulting outcome, or stated another way, the utility and value of REEIS is determined within the context of the activity in which it is used within a specific community (Ryder, 2000). The model in figure 1 illustrates this theoretical framework and shows a subject moving toward an object with a specific intention, working within a specific user community, and selecting a tool to meet the objective. This is an iterative process that continues until the 'correct' tool that satisfies the objective is selected. The tool represents functionality derived from the system requirements. The final tools (functionality) to be part of the prototype are those that are actually selected (enacted), and not necessarily those that are available (embedded). In other words the prototype is designed around those functions that the user actually draws upon to arrive at a solution, leaving behind those that were part of the initial design of the system.

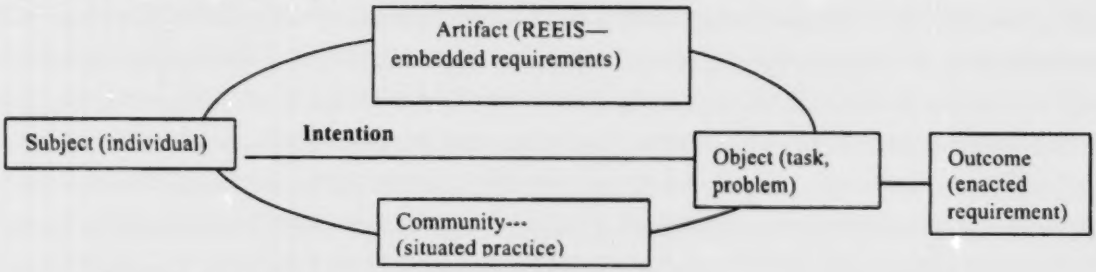

Figure 1: Joint Application Design

The techniques described above are characteristic of JAD sessions. Each session is made up of a community of users with common use traits and work requirements. Each session is designed around a specific use-case (the individual use-case is constructed from the initial set of system requirements derived from ethnographic records), involving human intentions, information problems, goals, tools, context and outcomes; in this case the outcomes are those REEIS functions that are actually called upon to reach a solution. From these selected functions a prototype is developed for further testing and demonstration (alpha mark).

The further testing and demonstration prototype continues until all communities (administrators, scientists, USDA program leaders, members of congress, etc.) of REEIS are able to satisfactorily complete all use-cases (beta mark). Examples of the use-cases include such activities as an end-user conducting a bibliographic search concerning forest sustainability, or for an intermediary to query the system for statistical /factual data on the 10 top commodities in each State, or for an administrator to aggregate/dis-aggregate data for decision making. On the technical side use-cases might additionally include, for example, providing technical search assistance, excavating for data, submitting query statements to the system, manipulating, synthesizing and reformatting data, etc.

The overall approach for developing the prototype is to establish a taxonomy of user tasks in order to visualize user/system interactions that will guide the final development of REEIS (Hert & Marchionini, 1997). The process is cyclical, iterative and one of logical deduction that produces an ongoing reduced set of problems until a permanent solution is reached (e.g. Carey & Mason, 1986; Naumann & Milton, 1982).

Discussion

The discussion section of this paper is partially framed around two constructs reported by Duane Truex and his colleagues. In one of their papers Truex, et.al. (1999) present a cogent argument for considering new assumptions about developing IS in organizations that are today in constant flux due to reinvention initiatives, the pressure for performance and accountability, the global economy, and the need to rapidly adjust to innovation. They call these organizations "emergent" suggesting that they are constantly seeking stability without ever arriving at it. The organization in which REEIS is being developed can be easily characterized as emergent.

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In a second paper Truex, et.al. (2000) present another construct that leads to a deeper understanding of the 'method concept' in IS design, development and implementation, questioning basic assumptions underlying conventional wisdom and methods in information systems development. In an interesting analysis the authors use postmodern deconstruction to present deferred definitions and assumptions of IS development methods that they call 'amethodical'. Table 2 identifies these definitions and assumptions.

Privileged methodical text	Marginalized amethodical text
• Information systems development is a managed, controlled process	• Information systems development is a random, opportunistic process driven by accident
• Information systems development is a linear, sequential process	• Information systems development processes are simultaneous, overlapping and there are gaps
• Information systems development is a replicable, universal process	• Information systems development occurs in completely unique and ideographic forms
• Information systems development is a rational, determined, and goal-driven process	• Information systems development is negotiated, compromised and capricious

Table 2: Assumptions and Ideals of Methodical and Amethodical Text. Modified from *D.* Truex, et.al., (2000)

Together these two constructs lend themselves to a critical analysis of the methods used in the development of REEIS as presented in this paper, and go to the heart of three questions: 1) Do situated IS development methods, such as ethnography, lead to a more effective understanding of user system requirements? 2) In contrast to qualitative methods what are the advantages/ disadvantages of ethnographic methods, specifically applied to IS development? 3) Is it possible to construct templates, formulas, and frameworks around ethnographic approaches to the design, development and implementation of IS.

The short answer to these questions, in the context of the REEIS project being grown in an emergent organization, is that any methodology for IS development that requires lengthy analysis and detailed procedures are poor investments. As Truex notes (1999) large-scale analysis and design projects are not cost effective in organizations that are constantly evolving, because they inevitably lead to obsolete system requirements that are largely imaginary since they point to a target that can never be reached in an emergent organization. Also, users engaged in large-scale analysis, often feel frustrated and trapped by a situation in which they are expected to articulate information needs that are yet and always evolving in an unstable environment.

A longer answer could involve the use of Truex's amethodical lens to take a retrospective look at REEIS' development to date, and determine, as the negative construct would suggest, that REEIS is being built "without a predefined sequence, control, rationality, or claims of universality" (2000, p. 54). The data and this researcher's experience with the project indicate that this is not entirely the case. However, there are a number of related tangents to the Truex argument that are relevant to this discussion and to the questions posed above. They also relate to issues and limitations in using ethnographic methods in IS development, and point to the idea that the methodology, as Truex would no doubt agree, cannot be reduced to a rule-based IS development practice. This perspective complements some very important observations made by Beynon-Davies in his discussion of ethnography, for and within IS development (1997).

The following is a summary of the Beynon-Davis observations in the context of the REEIS project. Ethnography is dependent on explicated knowledge underlying cooperative work, yet people all the time perform activities and skills without being able to articulate how they do them, what is called tacit knowledge. In the REEIS project an attempt to capture tacit knowledge was made by inspecting non-human sources, such as procedure manuals and documentation for defining tasks and operations. While this was generally an adequate strategy it would have been better to also construct artificial situations to trigger and elicit tacit knowledge from REEIS users, such as asking users to think about how they execute a particular information related task while they are doing it, then document their thoughts, feelings and behaviors as specifically as possible. The objective in ethnographic studies is to explicitly ground the investigation around observations, checking and modifying back and forth until the proposed explanation accounts for the data, and until new observations fail to inform previous observations. The JAD session plan described earlier does incorporate some of these strategies.

While the ethnographic account provides robust discourse, its lengthy and unstructured nature makes it difficult for modeling and analyzing. Contradicting the reflective theme of ethnography, its use in IS development must be accompanied by an organized schema tailored to the specific study in order to manage and make sense of the data. The schema used in this study was derived from the precepts presented in table 1. These precepts come from a variety

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of disciplines. The adequacy and accuracy by which these precepts are identified is therefore dependent on the depth and breath of the researchers interdisciplinary domain. In venturing into an ethnographic study structured as this one was, careful consideration should be give to this potential limitation.

The ethnographic approach is a time-consuming and costly methodology. Justifying its cost-effectiveness must include evidence that the organization is so unique and complex that it warrants an approach that is exploratory rather than prescriptive. However, with increased complexity also comes the need to cross-check and verify findings. The level of complexity in the REEIS project was increased when it became known that the project's stakeholders included Congress, the White House, other federal agencies, and the public at large. A purely quantitative study would have been inadequate given this complexity, and the number of variables needing to be examined. (Not reported in this paper are findings of a survey of REEIS users that quantified the study).

An additional potential limitation to the use of ethnography in IS research relates to the fact that the ethnographic record is nothing more than a snapshot of the workplace displaying a particular user behavior at a particular time, and does not necessarily speculate beyond that. Implementation of new IS should provide the potential for innovating work practices and for adapting new uses for technology. A challenge for the IS ethnographer, hence, is to effectively and objectively gaze into the crystal ball in order to speculate beyond what the data reveals, looking for new patterns and indicators all the while. These new patterns and indicators for each concept are sought until common instances are found repeatedly so that the concept can be considered saturated. For this reason the ethnographic record should be as detailed as possible referencing observed behaviors, documentation, and artifacts.

Of concern to the researchers in the REEIS project was, that unless conscientiously sought out, functionality requirements would be over shadowed by system design constraints. In the REEIS study, therefore, questions and probes specifically addressed what users liked or did not like about the use of current information technology, and what they desired for its use in the workplace. The researchers carefully looked for shared patterns of behavior specifically in terms of information creation, processing, storage, retrieval and use. In writing the ethnographic records explicit attention was given as to how effectively they would ultimately yield functional and technical system requirements.

Finally, a danger for an ethnographer coming from an information technology background used to a 'naturalistic account' rather than a 'reflective' one, is that of resorting to logical or rule-based explanations. Yet, as mentioned earlier, there is a need to have exactly this kind of logic and rules in place if sense is to be made from the collected ethnographic records. It is a slippery slope that the information system ethnographer maneuvers.

Conclusions

This paper concludes that while there is no unified method to the ethnographic approach, the construction of an analytical framework, based on anthropological/sociological theoretical schools, is an effective way of identifying personal sense making that include cognitive, affective and conative (action instinct) elements. In using ethnography for IS development work the emphasis should be on the kind of analytical framework that will explicate (or make observable) the real-world organization in which the information system will live. Ethnography, unlike other conventional qualitative methods, supports the kind of facetted analytical framework necessary to do good IS development work, but is not without limitations.

The paper describes how ethnography is used to plan the design, development, and implementation of a modern comprehensive web-based information system in the field of agriculture called REEIS. Each design/development/implementation component of the REEIS project is situated in one or more of the qualitative research traditions, depending on the data collection and analysis requirements, as well as on the orientation needed. Throughout the IS development work the research orientation has focused on ethnography as a way of taking account of the "reality" of the information retrieval situation. For example, in order to formulate REEIS system requirements in the context of the REE mission agency needs, it was necessary to view how users derive meaning from the experience they encounter. By applying ethnographic methods the real-world character of workplace activities was revealed, and hence system design goals (requirements) could be appropriately established. Without these pre-determined goals, or with the wrong goals in place, the system development work fails. The use of ethnography hopes to ensure that system development resonates with the circumstances of the system's use. In this project there was significant reliance on ethnographic records, constructed throughout the project, in order to generate initial system requirements and to build 'use cases' for prototyping REEIS. This heavy reliance on the ethnographic approach is a significant departure from conventional IS design methods that do not concentrate on social activities and the individual's construction of reality. As an extension of the ethnographic method, JAD sessions are being used to build a 'rapid prototype' of REEIS, where the 'proof of concept' is achieved through prolonged interaction between users and those engineering the system. Here

the research framework is based on activity theory where, with each iteration of the system, focus is on users and what they are attempting to achieve. This approach leads to understanding the intersection between an activity and the consciousness of the individual engaged in that activity.

Developing an ethnographic methodology for IS development is not an easy task. Nor does such an approach guarantee ultimate success, solve all design problems, or revolutionize IS implementation strategies. The full impact of ethnography for IS development can only be imagined for now. It will take many more projects such as REEIS and some time to pass before understanding the full potential of the methodology. Meanwhile, what is certain is that sociological/anthropological based approaches to IS development resonate well with the relatively new user-centered paradigm which has reconceived and fortified the IS specialization, particularly within the library and information science field. The main conclusion to be drawn is that information system design work must include user participation, and that the objective of the design is to empower the workforce through the expansion of knowledge. As Juup Esser and Jos Schreinemakers suggest this is particularly true today where knowledge can be considered an independent production factor next to (physical) labor, capital and natural resources (Esser, 1997). Accompanying the expansion of knowledge in the workplace means devising effective means for its management, as evident with the emergence of a variety of knowledge management practices and programs. These include the ability to capture and share explicit and implicit information in the organization, to focus on content, and access to content, and to develop organization information policies that relate to ethical and legal issues, such as confidentiality and intellectual property. The main conclusion to be drawn is that we should focus on the role of knowledge in the workplace and as Shoshana Zuboff writes, "not knowledge for its own sake, but knowledge that comes to reside at the core of what it means to be productive" (Zuboff, 1988). And, I may add, at the core of what it means to be a reflective practitioner in the field.

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Using Online Tools to Enhance Classrooms: A Case Study with MaSH (Making Serendipity Happen)

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Abstract: The middle ground between distance learning and standard-issue classroom education is ripe for exploration. In particular, the Open Directory Project shows that groups of people can create their own portals onto the Web. MaSH (Making Serendipity Happen) is a system similar to ODP that also allows users to rank and comment on information, allowing students and teachers to quickly create course-specific resources, with the best information found by one shared by all. A case study using MaSH to support a computer science course for pre-majors suggests it encourages students to spend more time and learn more about course topics while providing an easy way for instructors to get feedback and assignments from students and learn more about their interests.

Introduction

A middle ground exists between distance learning and standard-issue classroom education where tools for computer mediated communication (CMC) could supplement the traditional classroom. Tools from e-mail lists to integrated course environments such as WebCT support dynamic learning environments tailored to the task at hand and to the student performing it. However, many classes do not use these tools. Even in computer science, they often serve only as a one-way conduit of information from teacher to student (and much of this information is electronic copies of paper documents). One likely—and valid—reason that teachers avoid using these tools is the mindset that using such tools gives them even more responsibilities. *Someone* needs to find and organize the information; *someone* needs to answer the students' questions; and *someone* is busy already.

Assumed above is that *someone* is the teacher but this does not have to be so. The World Wide Web is a ready-to-reap garden of information. The Open Directory Project (ODP), a Web directory similar to Yahoo! but built by volunteers, is one tool for the harvest. Teachers and students could use a similar tool, working together as a group to create course-specific resources. Making Serendipity Happen (MaSH) is such a tool, allowing groups of users to explore the Web and share their discoveries. Group members can create directory topics specific to the course and fill them with Web sites focused on their needs. In addition, students can discuss what they find and rank the sites within a subtopic, allowing everyone access to the most useful and interesting information. Students can use this information to learn more and do better work while teachers can use it to learn more about their students. By creating a focal point for common interest, students might event become more interested in the course.

This paper presents a case study in which MaSH supported a pre-major computer science course. It begins with work that contributed to the development of MaSH, then outlines the software itself and some design considerations in building such software. It then presents the results and lessons learned from the case study.

Related Work

The inspiration for MaSH came from the field of CMC and the observation that education is often viewed as a one-way transaction of knowledge from teacher to students. Computers provide a number of tools that could support education (Hiltz & Wellman, 1997, Khan 1997). However, "most course-based or learning sites simply post course

[1] This work was completed at James Madison University.

materials. Use of the Web as merely an 'electronic book' falls far short of the potential the medium affords" (Hill 1997). MaSH's vision is to use the Web as a resource that students can mine, organize, and share. To this end, it borrows from other solutions to the problem of finding information on the Web. In particular, it draws on The Open Directory Project (Skrenta & Truel, 1998), a Web directory similar to Yahoo! but created by volunteers and with no centralized editorial control. In ODP, the editorial control rests at the level of categories. To promote the feeling of a truly shared, dynamic resource, MaSH allows any student to edit any part of the directory.

The notion of quality is a notable omission from ODP; apart from a "cool site" indication, links in a category appear in alphabetical order. It would be better if students had tools to find the most useful information. Obviously, the directory will be more useful if the best information is readily available. More important, students should learn the skill of evaluating information (for quality, authenticity, etc.). Programs that provide these facilities already exist. A number of "recommender systems" take user input and ratings for a set of documents and then use that input to filter or rank other documents. The first such system, Tapestry, used text annotations, which MaSH uses to facilitate discussion (Goldberg et al., 1992). Most later systems use numeric ratings that are both easier to give and to process. Even so, users are notably reluctant to rate (Konstan et al., 1997). MaSH attempts to counter these problems by modeling ratings as moving links up and down in a list. This strategy requires minimal effort from users, and fits well with the Yahoo!-style interface to the directory.

Landon (2001) maintains a comprehensive directory for courseware tools, such as WebCT and CourseInfo, which support integrated distance learning environments. These tools are not as well suited for enhancing traditional classroom settings, however. Their power comes with a steeper learning curve that is another factor discouraging teachers from using computers to supplement their classrooms. Running a class involves a number of distinct tasks (Hartley et al., 1997). MaSH can support or enhance a number of these tasks, including increasing (and possibly measuring) student participation, allowing for submission of assignments online, facilitating discussions, and supporting collaborative research and learning.

The MaSH Interface

The MaSH interface is similar to Yahoo!'s look and feel (Fig. 1).

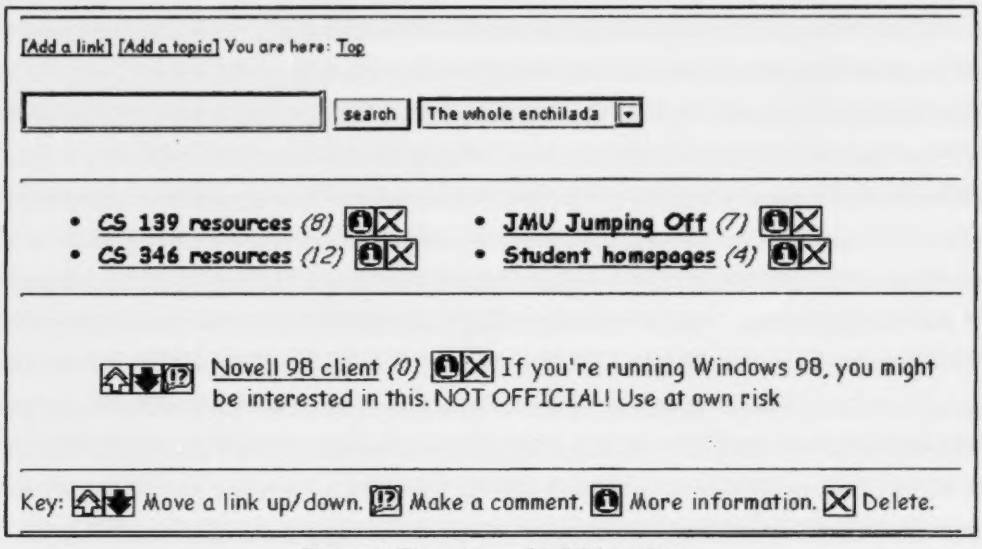
[Add a link] [Add a topic] You are here: Top
search
The whole enchilada
CS 139 resources (8)
CS 346 resources (12)
JMU Jumping Off (7)
Student homepages (4)
Novell 98 client (0) If you're running Windows 98, you might be interested in this. NOT OFFICIAL! Use at own risk
Key: Move a link up/down. Make a comment. More information. Delete.

Figure 1: The primary MaSH interface.

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Controls for moving, discussing, editing, and deleting links are readily accessible, and updates take place immediately. Simple keyword searches, within either the current category or the entire directory, are available. The controls for adding links and topics are not as prominent (see the top of Fig. 1). The icon legend appeared after some students found the icons confusing, particularly the icon for adding comments. Since Yahoo! has no public interface for adding links or categories, MaSH had to come up with its own (Fig. 2). Users can submit a title, URL, keywords, description, and parent topic for the link.

One concern was that the group would not come to a consensus on what was good and useful. Since the combined acts of all users determine the order of links, a link might yo-yo up and down as its champions and critics battled. The most difficult design decisions, however, involved identity and security. In the end, MaSH chose neither. Users can add links with their names, under an alias, anonymously, or even as other users. Nor are links owned—any user can edit or delete any link. In the small-group scenarios MaSH is intended for, the I believe that the gains in ease-of-use, simplicity, and shared ownership outweigh the cost in potential disruption and inability to collect detailed per-user statistics (which could be useful for certain educational applications, such as measuring participation).

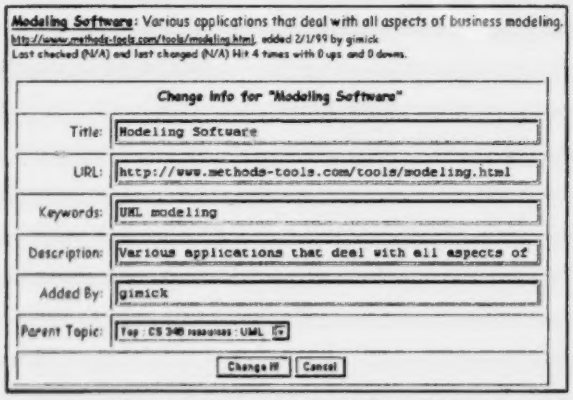
Modeling Software: Various applications that deal with all aspects of business modeling.
Change Info for "Modeling Software"
Title: Modeling Software
URL: http://www.methods-tools.com/tools/modeling.html
Keywords: UML modeling
Description: Various applications that deal with all aspects of
Added By: gimick
Parent Topic:
Change It!
Cancel

Figure 2: Changing or adding a link.

Case Study

MaSH was used to support a course called "Being Productive With Computers" taught at James Madison University. The course targets students interested in becoming computer science majors but do not have enough experience using computers to go directly into the computer science program. The range of assignments for the course is broad, including a generous helping of Internet use, research, and exploration. About 140 students, mostly first-semester freshmen, took the course. Most students were able to use MaSH almost immediately, even though students received minimal instruction and some students had only minimal prior exposure to computers.

A number of course assignments involved MaSH. For the following assignments, it was required:

- *Neat Sites*: students were required to find an interesting Web site and add it to the directory with a comment. This assignment was to familiarize students both with the Web and with MaSH.
- *Areas of Computing*: students were required to populate a number of subtopics representing areas of study in CS (databases, theory, etc…), in order to learn what computer scientists do besides "program".
- *Submitting assignments*: students were required link to Web pages they created for two assignments, a My First Homepage assignment and a position paper on an ethical issue in computer science.

In other cases, use of MaSH was optional (but encouraged):

- *Supplementing lectures*: several subtopics pertained to lecture topics that students on which students needed more help (in particular, units on *HTML* and *number* systems).
- *Sharing links for research*: students wrote several papers throughout the semester; students were encouraged to use and add links to topics created for these assignments.
- *Discussions*: students could post comments in Q-and-A and course feedback topics.

Overall, MaSH received 54,916 hits (Tab. 1), with students viewing Web sites (the "View Link" action) 12,394 times (22.6% of total activity), navigating the directory (the "View Topic" and "Welcome/Help" actions) 38,329 (69.8%), and modifying the directory 4,193 times (7.6%). Sites visited and links added varied greatly by assignment (Tab. 2). In particular, the four assignments that had over 50 links added all required students to add links to MaSH.

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Action	Count	Pct.
View Topic	38284	69.7%
Visit Link	12394	22.6%
Request Add/Edit	2150	3.9%
Add Item	1259	2.3%
Edit Item	416	0.8%
Rank Item	240	0.4%
Delete Item	128	0.2%
Welcome/Help	45	0.1%
Total	54916	100.0%

Table 1: Overall activity frequencies.

Topic	Hits	% Hits	Links	H/L
Homepage	7125	57.5%	189	37.7
Neat Site	1987	16.0%	236	8.4
Projects	1009	8.1%	53	19.0
HTML	899	7.3%	14	64.2
Numbers	321	2.6%	5	64.2
Areas	316	2.6%	130	2.4
History of Comp	258	2.1%	2	129.0
Discussions	185	1.5%	5	37.0
Sources	106	0.9%	2	53.0
Final Exam	92	0.7%	1	92.0
Position Papers	78	0.6%	23	3.3
Other	13	0.1%	3	4.3
Total	12389	100.0%	702	17.7

Table 2: Hits and links, by assignment.

In some instances, students used MaSH beyond the course requirements. For example, in the *Homepage* assignment, each student was required to post a personal Web page and to visit and grade the pages of three fellow students. The goal was for each student to learn about HTML, to practice evaluating others' work, and to learn more about a few of their fellow students. Students were enthusiastic about this assignment. Some created very ornate pages, and many students visited each other's pages far more often than required, as evidenced by the average of 40 visits per homepage. A similar pattern prevailed for the *Neat Sites* assignment, which was the first assignment of the semester. Many students contributed more sites than required, and students both contributed and visited links from this assignment throughout the semester. For the *Projects* assignment, groups of students had to post an informational Web site devoted to a computer science topic (e.g. DVDs, computer security). They were not required to visit other groups' pages—but many students did. All of these cases point to students learning and experiencing more than they otherwise could have if the course had not used MaSH.

Students also made heavy use of MaSH topics that contained supplemental information related to assignments. These topics included *HTML*, *Position Papers*, *Numbers*, and *History of Computing*. In each case except for *Numbers*, the instructor posted a few links. Students used these links heavily and added several of their own, particularly for the *HTML* and *Position Papers* topics. This suggests that students did more research about course topics and perhaps learned more about them than they otherwise would have.

Students used the evaluation features of MaSH (link ranking and comments) infrequently, ranking links 240 times and making around 300 comments. Several factors probably contributed: the icons were confusing, no assignments explicitly required evaluation, and there was no easy way to add a comment when submitting a new site. Even if these issues had not arisen, however, Avery and Zeckhauser (1997) argue that people will in general require some sort of external compensation in order to provide ratings in a recommender system. Ideally, teachers could design assignments that would help students internalize the value of providing ratings; however, tying them to grade is more likely to actually garner ratings. Students did use the comments to give course feedback in the *Discussion* topic, showing that MaSH can be a lightweight tool for adding asynchronous discussions to a class where the instructor wants to use the system for its primary purposes of sharing information.

Students occasionally made spontaneous use of MaSH. One student (who asked first) posted a link relevant to the take-home final exam. Another pair of students created and populated the *Numbers* topic. Students made heavy use of both topics. "Anonymous" created a topic that got some play, *Interracial Interaction*. It originally appeared with eight links. Most of the titles and descriptions were vague, like the link titled "Interesting: definatly [sic] worth looking at." The links mostly pointed to sites with racist views (e.g. the KKK). One might expect complaints, or perhaps angry discussion and comments attached to the links. This did not happen—the links received around 100 hits total with no comments added and no complaints received. Two of the links, however, disappeared, and anonymous students altered the rest to point to innocuous sites such as Microsoft. One link, originally described as "White Power", was changed to "white flower" and redirected to the Betty Crocker home page.

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Lessons Learned

The most practical lesson learned from the case study is that MaSH can improve a classroom. MaSH gave students a way to find and share information on difficult topics and topics they cared about. Students used MaSH a great deal for these purposes, suggesting that many students spent more time learning about course topics than they otherwise might have. MaSH also gave students an outlet to comment on the course in a safe, anonymous way. For the instructor, it provided a means to receive honest and direct feedback, a convenient way to collect and review assignments electronically, and a way to let students help each other learn the course material.

The case study strongly suggests that use of the system depends on how, and how interested, students are in a topic. Three patterns of use emerged (Tab. 3). The first pattern includes high volume topics with many links and a moderate to high hit per link ratio. A second pattern covers topics that have a high average number of hits per link, but few links. The third pattern contains relatively inactive topics, which had a very low number of hits per link.

Pattern	Topics	Hits	Links	H/L
High volume	Homepages, Neat Sites, Projects, Discussions	10306	483	21.34
High hits per link	Numbers, History, Sources, Final, HTML	1676	24	69.83
Inactive	Areas, Position, Other	407	156	2.61

Table 3: Three distinct patterns of use indicate kinds of student interest.

The reasonable explanation is that these three patterns correspond to why a topic matters to users. High volume topics are those where users had an intrinsic or strong interest in the subject, such as publishing *Homepages* or visiting *Neat Sites*. High hits per link topics suggest an operational interest: the material was useful for some task, such as learning about *HTML* or getting help with the *Numbers* and *History* assignments. Students used these topics in a markedly passive way, with few contributions but many hits. The inactive topics appear to be topics that students did not see as useful or interesting. The *Areas of Computing* topic is a fine example. Students were required to add several links each in order to get credit for the exercise, but few used these links. Instructors could monitor the ratio of hits per link added to check the "health" of the system—too few or (when student contributions are solicited) too many hits per link suggest a topic that is not faring well.

The case study also supports the decision to forgo security and identity. At least in a small-group setting, problems involving deliberate sabotage of the directory or impersonation of identities were not severe—even in a computer science setting, where at least some of the students might have greater-than-normal skills at causing mischief. The one potential incident, the *Interracial Interaction* episode, showed a community policing (censoring?) itself: objectionable material went into the directory and was gone shortly thereafter. Hiltz and Wellman (1997) describe a similar incident while discussing the social dynamics of online communities, which they feel are much like those of communities in general—including having an unstated but clear social norm for behavior. MaSH enables these norms to form by providing every member of the community the ability to make comments, move links around, and delete links. Students can vote low-quality links downward, attack them in annotations, or just remove them.

Several conditions in the case study were necessary to the success of MaSH. Students must have access to computers, which would limit its use in low-budget settings. The course topic must be amenable to using information available on the Web. This is becoming less and less of an issue, as information from all disciplines migrates to the Web, but is still a consideration. The instructor must have access to a system on which to run MaSH (a Web server with CGI scripts enabled and the Perl language is sufficient). Finally, the instructor must ensure that students understand the value of the course topics and the value of a shared information repository.

Future Work

Although not needed in the case study, features for security and identity might be worth adding to MaSH. Imposing a short (5 to 10 second) delay when responding to users deleting or editing links would discourage all but the most dedicated miscreant from random sabotage. Moderation is already possible, simply by using the system as any group member would. Collecting recent activity in one place for review in a "what's new" page would make moderation easier and allow instructors to quickly get a feel for how students were using the directory. One caution, however, is

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that moderation might have a chilling effect on participation from students whose contributions were deleted. Adding identity to the system would allow instructors to track and reward contributions, and to learn more about the interests of individual students. Again, however, this route is fraught with danger—the quality and use of conscripted contributions is uncertain, as shown by the Areas of Computing failure.

The interface has room for improvement. The "what's new" page described above would be useful for everyone, not just moderators. Better icons would help users, while controls for adding to the directory should be more prominent. Another way to solicit more content would be a small second window that made it easy to submit links while surfing, similar to the itList online bookmark manager's PuppyDog (Frankovitz, 2001). Finally, students would probably comment more if they could add a comment at the same time as they add a link.

Conclusion

MaSH was useful in teaching the course. It helped students share information and learn more about the course topics and about each other, while providing the instructor with feedback and easy access to student work. Further studies would show useful it is in other domains and at other levels of education, but MaSH can be a useful addition to the teacher's toolkit. MaSH can give members of any online community the power to benefit from each other's knowledge and effort—making serendipity happen.

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Effective discourse styles in asynchronous online collaboration

Extended Abstract

Instructors use the online collaborative group process for individual classes and whole curriculums. Facilitators often base their practice on face-to-face group process theory. Yet, online communications seem to change the way people think, problem solve and interact (Abdullah,-Mardziah-Hayati, 1998). Telecommunications redefine the spatial and temporal parameters of the interaction they mediate so that online discourse is taking new directions, particularly in the way people write. (Tomow, 1997, p.1) Kimball states faculty need to learn the dimensions of the new instructional medium. "New technology requires us to rethink these dynamics because we don't have the option to use familiar approaches" (Kimball, 1998, p.1). Several research projects conducted at a large private university give insight into facilitating online discussion and the differences with face-to-face facilitation. Very effective discourse styles for online collaboration have emerged from these studies.

Method

The presentation will report on the following studies: face-to-face collaborative group process conducted in a technical writing class and based upon Collaborative Problem-solving Theory by L. Nelson (1999); a qualitative study of an online fifteen-week family nursing project where 1179 electronic mail messages were analyzed for categories, concepts, and constructs; a comparative study of two online groups judged by three facilitators as producing the best and least effective outcome products; and an action research study conducted of the fifteen-week nursing project.

Findings

Although successful face-to-face and online groups share a lot of similarities, the differences are significant. The differences include the choice of subject matter, the time allowed for problem solving, facilitator behavior, and even group process.

Nelson has documented the naturally occurring steps that expert collaborators go through in successful face-to-face collaborative problem-solving. These steps are (1) Build readiness for the collaborative process, (2) Form and norm groups, (3) Determine a preliminary problem definition, (4) Define and assign roles, (5) Engage in an iterative collaborative problem-solving process, (6) Finalize the solution or project, (7) Synthesize and reflect, (8) Assess products and processes, and (9) Provide closure. The qualitative study of group processes in a face-to-face collaborative environment shows that successful groups did indeed follow these steps.

The studies of online groups, though, show the need for adjustments in the electronic setting. Complex subject matter works well in a problem-based learning or cooperative environment. The online group requires more time than do face-to-face groups to develop cohesion so the online group can't be used for short-term assignments. Tasks without fixed starting and ending points, and requiring the participation of all members to define the learning process adapt well to the online format. Facilitators of f2f groups can allow groups time to form their own heterogenous groups. The online process, on the other hand, takes more time and can benefit from instructor formation of the groups.

The environment established by the facilitator and group impacts the process and product. Online language and metaphor create the ambience. The facilitator focuses on the outcome desired and then builds the imaginary space that produces the type of communication needed to produce the emotions and process. For example, some groups projects may need a kitchen table metaphor to produce informal discussions and debate, while other projects require a boardroom metaphor to encourage formal presentations.

The comparative study of two online nursing groups found the mental metaphor used by group members affected how participants used the media and the quality of the product. The most effective outcome product group sent twice as many messages with 3 times as much content. Their metaphor described the group as an informal place to go and problem solve before producing the assignment. Ninety-four percent of all messages included validation of each other and the group: encouraged, praised, addressed individuals and their issues, agreed with each other, and built on each other's ideas.

The lack of visual presence contributed to several differences in group processing between the face to face and online groups. Interviews of online participants indicated time was needed to develop cohesion among

members. The first and last paragraph of email often contained sentences sharing life experiences and giving an emotional picture of the writer (Molinari, 1998).

The greeting and conclusion paragraphs acted as substitutes for visual cues. Students announced their communication purposes, defined boundaries, asked for social support and tried to create a shared reality before and after the message body. During the project students rarely used threading in the subject line. The subject line announced substance, purpose, priority and emotions. Further study of these adaptations may give clues for understanding the psychological cyberspace climate.

The online groups struggled with the time taken between sending and receiving messages. A "democratic abbreviated discussion" form developed. Students reflected before writing their opinions. Their message substance began with a thesis statement and was followed by supporting statements. Group members used organizing elements from both written and verbal communication. Numbering supporting ideas is often seen in document while verbal cues like "Well" and "uhm" were used to change topics.

Conclusion

Facilitators need to understand collaborative group process research and how to adapt it to online settings. Online participants create a mental metaphor for the group, which impacts process and outcome products. Online members adapt past experiences and invent new methods of communication to the online setting.

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The Human Use Regulatory Affairs Advisor: A Web Based Information Retrieval System with a User-Friendly Interface Design

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Abstract: The Institute for Computational Discourse Technologies is developing a user-friendly, web-based information retrieval system designed to minimize platform requirements and maximize usability, while employing readily available technologies. The system consists of three components: a user interface in the form of a web browser with an avatar; a digitized library organizing the data in a standard relational data base; an application server that accepts input from the user and interacts with the digitized library to dynamically compose web pages. The Human Use Regulatory Affairs (HURA) Advisor gives the user strategic advice aimed at optimizing information retrieval. The knowledge base of the HURA Advisor includes various documents on Institutional Review Boards taken from federal, civilian, and military sources. This paper focuses on the web usability of the HURA Advisor, how its avatar serves as a navigational guide, and how the system manages interactions that occur between a user and the system.

Introduction

The Human Use Regulatory Affairs (HURA) Advisor is being developed by researchers at the Institute for Computational Discourse Technologies, an interdisciplinary team of cognitive psychologists, computer scientists, and engineers at Thoughtware Technologies, Inc. The HURA Advisor is designed to help users learn the policies and regulations that pertain to using human subjects in research that is funded by the U.S. Department of Defense. While developing the HURA Advisor, we encountered both psychological and technological challenges. The psychological constraints required that we develop a web-based help system that was accurate, efficient, and user friendly. The technological constraints demanded that our system be scalable and compatible with industry standards and the Advanced Distributed Learning Initiative, such as the Sharable Content Object Reference Model (SCORM). We also wanted to minimize computational requirements performed locally, in order to allow the user's platform to perform as a thin client.

The current version of the HURA Advisor addresses these challenges. Four requirements were implemented to meet the psychological constraints. First, the curriculum is organized into a hierarchical format that reflects the relevant federal regulations (i.e., 45 CFR 46; 32 CFR 219). Second, the avatar (taking head) provides navigational guidance in each of six learning trajectories. In order to avoid navigational uncertainty, the talking head is under the control of a Dialog Advancer Network (DAN). Thus, the talking head is always available to offer advice to the user concerning what to do next. Third, a point and query feature is included in selected learning trajectories. By simply mousing over specified parts of bulleted information, the user is presented with lists of context-sensitive questions that experts deem critical to illuminating the important information contained in the particular contents. Finally, latent Semantic Analysis (LSA) is always available to provides an intelligent search of the database anytime users choose to generate their own questions and submit them in English.

To meet the technological challenges, we organized the curriculum into a relational database that is structurally equivalent to SCORM. An intelligent learning management system (ILMS) provides a server application that works with the relational database. This IMLS manages interactions between the user and the HURA Advisor. Because the workloads of both the curriculum (database) and management system are located on separate servers in remote locations, the user's platform functions as a thin client, requiring only the Windows ME operating system, or some of the equivalent software. This architecture was adopted because the

HURA Advisor is too computational intensive to run in real time on most platforms functioning as thick clients, that is, on platforms that have downloaded much of the architecture of the HURA Advisor itself.

Using the HURA Advisor

At the HURA Advisor web site the user provides a user name and password and then selects from a list of user profile categories and purpose-of-visit options, before logging on. The first time a user logs on, a page listing minimum platform requirements is presented (e.g., Pentium 200 or higher), along with software programs (e.g., Microsoft Agent core components) the user would need to download if the standard installation of Windows ME is not available. Any software programs needed to support the HURA Advisor architecture can be downloaded directly from this page by simply selecting appropriate links. This page also specifies the size (e.g., 395 KB) and approximate download time (e.g., two minutes on 56K modems) for each of the programs available to download. Once the user hits "click here when you are ready" a brief flash-movie introduction begins. This movie, created in Macromedia Flash 5.0 (www.macromedia.com), provides some historical information and describes the importance of the three Belmont principles: beneficence, justice, and respect for persons participating as subjects in research. Some of history's worst cases of human subject abuse, such as Nazi concentration-camp research, the Tuskegee syphilis study, and the Willowbrook study are highlighted in this part of the movie. The purpose is to grab the user's attention and then concentrate on the three Belmont principles. The remainder of the introduction is designed to reduce the volume of text the user has to read and to explain how to use the interface. The end of the movie takes the user to the first page of the interface.

The User Interface

The functionality of the interface, created in the Delphi 5 Enterprise Version for rapid prototyping, will be described from the user's perspective. The first page of the multimedia interface, which includes an avatar created in Curious Labs Poser 4.0 (http://www.curiouslabs.com) that is controlled by Microsoft Agent (http://msdn.microsoft.com/workshop/imedia/agent/default.asp), can be seen in Figure 1. The avatar, or animated agent, with a female persona, remains on the upper left part of the screen throughout the interactive session. As indicated earlier, the agent is an omnipresent navigational guide offering suggestions to the user on what to do next in order to optimize information retrieval (Johnson, Rickel, & Lester, 2000). Depending on the user's needs at the time, the agent's interactions are under the control of a generic dialog advancer network (DAN), or several context sensitive DANs. These networks will be described in the next section of the paper.

Located directly below the agent on the interface are an Introduction option, which simply replays the movie, six learning trajectories, and eight other options. All of these options are always available to the user throughout the session (see Figure 1). Each of the learning trajectories is described in a later section of this paper. Some of the learning trajectories are designed specifically to get users to actively engage with the contents (i.e., Lessons, and Explore Cases). Others simply present the user with hierarchically structured texts, and users are encouraged by the agent to "drill down" through the contents of the information. In addition the agent reminds the user of other exploration options. For example, the agent might suggest that the user submit a question about the contents, or that the user review a case relevant to the [illegible] being explored. The system tracks the progress of each user. This feature permits the HURA Advisor to decrease probabilistically the frequency with which the agent gives various kinds of navigational information or makes suggestions, either as the user interacts with any given learning trajectory, or when the user returns to the HURA Advisor web site at a later date.

Figure 1: Opening page of the HURA Advisor's Multimedia Interface

The other eight informational options are provided directly below the six learning trajectories (see Figure 1). These options are as follows: Glossary, Archives and Links, Module Descriptions, Replay Video, Bibliography, System Requirements, Help, and Log Out. When the user mousses over any of these options, the agent gives a brief description. Like the learning trajectories, these eight options are available for users to select at any time during the session.

The remainder of the interface, basically the center and right side of the screen, is the content window. This is where all the content-sensitive information is presented to the user when one of the learning trajectories or other options, such as Glossary or Archives and Links, is selected. Two navigational options are always available on the content window, "Next" and "Previous." These buttons, standard on most web browsers, take the user to the next page or the previous one.

Dialog Advancer Networks

A Dialog Advancer Network (DAN) is a mechanism that manages interactions between the user and the HURA Advisor. A DAN allows the agent to micro-adapt each dialog move to the user's navigational choices. The HURA Advisor contains several DANs with customized pathways that are tailored to the special requirements of each of the six learning trajectories. The purpose of the DANs is to prevent navigational uncertainty for the user by always having a dialog move available that presents options to the user concerning what to do next. In earlier automated tutoring research we found that learners were frequently lost, not knowing what to do next, in the absence of a DAN (Person, Bautista, Kreuz, Graesser, & TRG, 2000).

The generic DAN encourages the user to select one of the learning trajectories; once a trajectory is selected one of the context-sensitive DANs takes over. Because each of the learning trajectories involves a

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distinct way of presenting information, it was necessary to create the various context-sensitive, or trajectory-sensitive DANs. This was done in order to provide maximal navigational guidance (e.g., Johnson et al., 2000).

Six Learning Trajectories

Historical Overview.

One learning trajectory, located directly below Introduction (see The User Interface, Figure 1), is Historical Overview. As indicated earlier, selecting Introduction (the first option directly below the agent) simply replays the movie described above (see The User Interface). When Historical Overview is selected, a bulleted list of historical documents and access to several notorious cases appears (e.g., the Nuremberg Code, Well Known Cases of Human Subject Abuse, the Belmont Report). Selecting any of these bullets "drills down" to the next level, which contains specific information about the document, and an opportunity to ask an English language question to directly query the documents themselves. This trajectory also includes a point and query feature. Each of the bullets has a highlighted question mark in front of it. If the user mousses over the question mark, it pops up a list of two to five questions.

For example, if the user mousses over the question mark to the left of The Belmont Report bullet, a list of three questions is presented: "What is the Belmont Report?", "Why is it called the Belmont Report?", and "How is the Belmont Report related to the Nuremberg Code?". When any one of the questions is selected, a pop-up window containing the answer is presented. In addition, if the Belmont Report bullet itself is clicked, it has the effect of drilling down to the next hierarchical level, where further information on the Belmont Report is provided, along with other point and query options. There are two reasons for the point and query option: to allow users to easily submit questions that will then produce information experts deem critical to the particular contents, and to minimize demands on the user. The DAN for this trajectory contains dialog moves that always keep the user informed about what to do next. The agent might say, for example, "Learn more about the Nuremberg Code by clicking here," or "Select a question by mousing over the question mark to the left of the bullet."

Explore Issues.

When the user selects Explore Issues, a page is presented containing bullets that correspond to seven critical issues derived from the Belmont Report (Emanuel, Wendler, & Grady, 2000). The information in this trajectory is presented in a three-level hierarchy. The seven critical issues are presented at Level 1. When one of these is selected, a list of Level 2 'Topics' related to the specific critical issue is presented. Level 3 contains very specific 'Points' related to the Level 2 topics. Like Historical Overview, Explore Issues also includes a point and query feature. When the user mousses over the highlighted question mark to the left of the bullets at all three levels, a list of questions experts deem important to the bullet's contents pops up, and selecting any of the questions brings up the answer.

Lessons.

First time users are encouraged to work through the Lessons trajectory first. When this option is selected, the agent tells the user to select "Lesson 1." In Lesson 1, the user is introduced to the seven critical issues discusses in the previous section. The agent then suggests that the user select a specific historical case (i.e., the Tuskegee Syphilis Study) to read after the seven critical issues are read. When the user indicates the case has been read, information is presented that delineates how each of the seven critical issues was violated in the historical case. The agent then tells the use to select the next lesson (Lesson 2). After reading about a new case, the user is asked to select which of the seven issues were problematic in the case. The HURA Advisor then provides feedback concerning the issues the user has selected and not selected. The feedback is based upon experts' evaluations of the cases. Lesson 3 continues in this manner: the user reads the case, the user selects problematic issues, and the HURA Advisor then provides feedback to the user. Lesson 4, the last in this trajectory, is selected dynamically based upon the user's performance during Lessons 2 and 3.

Explore Cases.

When Explore Cases is selected, bulleted options that correspond to ten controversial cases are presented in the content window. The agent tells the user to "Select a case study to read, and then test your knowledge of the

seven critical issues by selecting the 'Test Your Knowledge' option." On the Test Your Knowledge page, the seven critical issues (see Explore Issues) are presented, and the agent instructs the user to select the problematic issues for the specific case. Once the user finishes the issue selection, the HURA Advisor provides feedback on the selections.

User choices consistent with expert opinion are denoted with explanation marks; choices not consistent with expert opinion are highlighted in red and denoted with question marks. Following both misses and false alarms, additional feedback is provided if the user mousses over a particular issue. After the feedback phase, the HURA Advisor presents a "Summary of Issues" option. At that point, the agent might say, "You can select the 'Summary of Issues' option to review the problematic issues in this case."

Decision Making.

This option is designed to help the user make a decision about a particular research protocol. When this trajectory is selected, a bulleted list of nine distinct research areas appears in the content window. The nine research areas included in this trajectory are General Consequences, Basic Biomedical Research, Drug and Vaccine Trials, Radioactive Materials and Xrays, Epidemiological Research, and Training and Weapons Development. Once a research area is selected, a bulleted list of typical ethical problems that occur in that particular type of research is presented. When any one of these bullets is selected, the HURA Advisor presents information concerning how to avoid the ethical problem, along with the potential consequences of specific ethical violations.

Query Documents.

The final learning trajectory in the current version of the HURA Advisor is Query Documents. When this option is selected, the user can select a number of specific types of documents that are related to the use of human subjects in research (e.g., the IRB Guidebook, Department of Defense documents, Army, Navy, Air Force regulations, various Codes of Federal Regulations). The agent tells the user, "You can search any of these documents by clicking the box next to the document." The user can search one, or any combination of documents by entering a question in English. When the search is completed, the agent might say, "Look below the dialog box for the results of the search."

Latent Semantic Analysis (LSA)

At any time during a session, the user may ask a natural language question in English. The knowledge in the HURA Advisor pertaining to Institutional Review Board practices and procedures is represented by LSA (Hu, Graesser & TRG, 1998; Landuaer, 1999; Landauer & Dumais, 1997; Landauer, Foltz, & Laham, 1998). This is a statistical procedure that compresses a large corpus of texts into a space of approximately 100 to 500 dimensions. This N-dimensional space is used to evaluate the similarity between any two bags of words. The relevance or similarity values vary from 0.00 to 1.00.

In most applications of LSA, a geometric cosine is used to evaluate the match between the N dimensional vector for one bag of words and the vector for the other bag of words. In the HURA Advisor, one bag of words is from the user's input (e.g., specific issue, case, or typed text). The bag of words it is compared to is the documents. The LSA space for the domain of IRB procedures was derived from a variety of documents (i.e., IRB Guidebook, Codes of Federal Regulations, DoD documents, Army, Navy, and Air Force documents), plus a corpus of approximately 15,000 questions probing these documents. The questions were created by the Institute for Computational Discourse Technologies.

An LSA analysis requires the preparation of a document by word (D x W) co-occurrence matrix. Each cell in the matrix specifies the number of occurrences of word W_i in document D_j. The computation of the N dimensions is then derived from a statistical procedure called singular value decomposition. In order to prepare the D x W matrix, the researcher needs to define what constitutes a document unit. A single document was defined as a paragraph in the various IRB, DoD and military documents, and as a single sentence in the corpus of 15,000 questions.

Summary

The HURA advisor was designed to meet both technological challenges and psychological constraints. In order to meet our technological requirements, the bulk of the system is located on remote systems that contain relational databases and an intelligent learning management system (ILMS). By integrating these two modules, we have used already existing technologies to create a thin client that produces minimal resource drain on the user. Furthermore, the relational database and the ILMS are SCORM compliant in that their content can easily be shared with other SCORM compliant programs. These technological challenges allowed enough flexibility to meet the psychological constraints on the system. The system provides a user-friendly, web-based interface with an avatar that is controlled by the system and provides navigational guidance through six different learning trajectories.

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Co-operative Learning in an Immersed Internet -based Virtual Learning Community – the Good, the Bad and the Ugly.

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Abstract: The University of Pretoria presents a masters-level degree in computer-assisted education, incorporating a module on Internet -based learning. This module uses creative, constructivist and collaborative learning techniques via the Internet to simulate the communicative aspects of a real classroom in a web-environment. Using the Hexa -Metamodel as an evaluation perspective, the paper shares successes (good), and problems experienced (bad & ugly).

Introduction

The University of Pretoria, a contact -teaching institution, presents a two-year masters' degree in Computer -Integrated Education, yet one of its modules, *RBO-880* has, since 1995 taught *Internet-based Learning* using the Internet as medium (Cronjé 1997, 2001; Cronjé & Clark, 1999). The idea is to give the learner-educators first-hand experience of constructivist distance-learning and collaborative tasks, so as the better to manage Internet -based learning and communication with their own target learners. This paper presents the results of our ongoing formative evaluation research into the dynamics of learning theory and instructional design -and- practice in this novel Web-based learning environment. As an evaluation toolset, elements of the Hexa-C Metamodel (De Villiers, 1999, 2000, 2001) are applied to investigate:

- Can a "classroom" and its activities be successfully simulated on the Internet/World Wide Web?
- From the viewpoint of learning theory, to what extent does the instructional design of the *RBO* classroom implement the following three elements of the Hexa-C Metamodel:
  (i) creative instruction, (ii) constructivism, (iii) collaborative learning?

RBO has progressed through the five levels of web use (Harmon and Jones (1999) and is currently *immersive*, namely a constructivist *virtual learning community* with all its content and interaction online. In this context, we evaluated the *RBO* presentations of 1999 and 2000 using the Hexa-C Metamodel (HCMm), a concise set of theories/characteristics of contemporary learning design and practices from the cognitive family. Of its six elements: creativity, constructivism, collaborative learning, cognitive learning, customisation, and components, we used the first three as tools of enquiry. The paper summarises some of *RBO*'s (i) good - (ii) bad and/or ugly
features and experiences. Under each header, an investigation was conducted using the three 'C' tools.

The Good

The RBO web-classroom uses the metaphor (Branscomb, 1996) of a junior school classroom. The instructor-designer set out to mimic, in a ***creative and innovative manner***, objects/events of its real -world counterpart. There is no face -to- face communication, nor any meetings, but rather a system comprising a *web -classroom* (*http://hagar.up.ac.za/rbo/2000/index.htm*) to represent a physical classroom (see Fig 1) and a mailing list for interpersonal interaction (*talking*), together forming a *virtual settlement* (Jones, 1997).

Figure 1 presents the 2000 website, simulating attributes of a physical classroom. The buttons link to objects such as tasks, timetable, classmates, and instructor's desk - which branches to his personal home page. References (resource cupboard and tool box) link to literature and construction programs such as HTML editors, graphics utilities, and website construction tools. Others access academic information, such as the course topics, grading system, required outcomes, and the practical competencies learners should acquire. The *poster wall* links to students' projects, and the *blackboard* is implemented as a graphics file. As a challenge, students may access and edit this chalkboard, which simulates a graffiti wall. Classroom objects proliferate as the course proceeds. From learners' perspectives the most important area is the central region for their self-constructed, auto-customized *desks*. Each mini-desk in Fig 1 links to a full-scale desk (or study), two of which are shown in Figure 2. They represent the *scholar's* personal traits, formality/informality, web-skills, etc. The creativity of the theme ***engendered creativity among learners***, in both their desks and in the content and presentation of the deliverables they generated as their tasks.

The artefacts on/around each desk – objects typically found in a school desk - are hyperlinked to the learner's own *RBO* site. These are a *utility bag* (links to useful sites, e.g. editors, search engines, clipart libraries); *books* (useful resources); my *hobbies* (links to sites of personal interest; my *class work*(including links to joint projects); and my *portfolio* (a link to the major individual examination project).

RBO is highly ***constructivist*** in ethos. Not only did learners find information on the WWW, but also generated web pages as part of individual and collaborative projects. Construction is transparent, in that the developing artefacts are accessible to peers. There is active participation, discovery-learning and no direct instruction. Learners with initial low web -skills tackled independent learning, using peers or links to tutorials - termed *extra lessons* - analogous to a class in school. RBO led to transfer, as skills were later used in real -world employment.

Figure 1 Website of the RBO electronic classroom

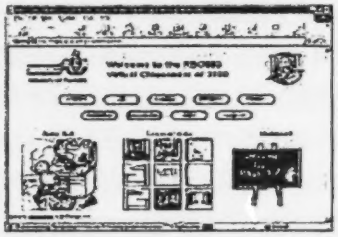

Figure 2 Desks of two of the *Class of 2000*

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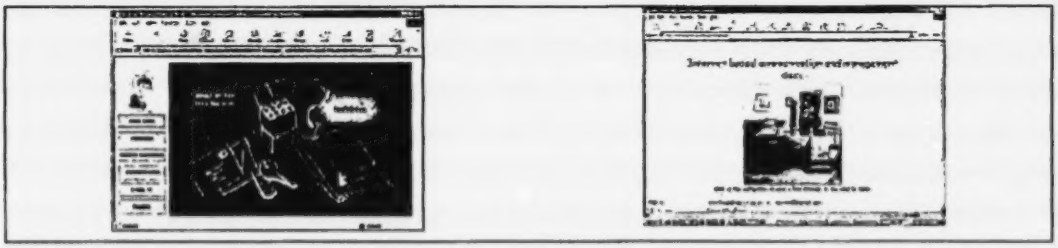

Regarding ***collaborative and communicative* aspects**, the tasks are designed to provide Johnson & Johnson's (1991) key elements of co-operative learning: a mutual goal, positive interdependence and individual responsibility. Role allocation and work distribution under distance-collaboration have unique characteristics and entail different media, such as discussion and debate via a dedicated mailing list. In line with the metaphor, some students *down-aged*, addressing the instructor as "Teacher" in emails. They tattled on one another, made jokes, and one played truant, replacing her desk with a beach and surf kit. This roleplay and humour contributed to team spirit, in keeping with Baym's (1995) contention that "... humorous performance can be used to create group solidarity, group identity, and individual identity in CMC". Initial RBO classes lacked synchronous interaction and its associated urgency, a matter that has been partially addressed by *Chat* sessions.

An analysis of the messages sent through the class discussion list (Cronje & Clarke, 1999) indicate that the most frequent actions of the instructor were to make suggestions, give encouragement, explain how to do something, and give directives. The main actions of the learners were to provide information, ask questions, present their problems, initiate/contribute to discussion, and offer humour – typical scholar-behaviour. It appears that the communicative acts in the Web-class are similar to speech acts in a face-to-face classroom, indicating that "Computer-mediated groups can create solidarity through developing interpretive consensus" (Baym, 1995).

The Bad and the Ugly (issues and solutions in constructivist collaboration)

Students with a skills-gap experienced ***constructivist frustration*** and *cognitive conflict* (Perkins, 1991). The distance-variant of constructivism and challenge exacerbated the problem, causing feelings of isolation.

True self-paced work - a ***constructivist*** ideal – cannot be fully implemented in a formal teaching institution, nor is it compatible with collaborative learning. Individual projects are impacted by time factors, particularly where the adult learners are interrupted by professional demands or personal commitments. Learners who do surveys as part of their projects experience response delays. It must be stressed, however, that *RBO* is more about learning, than about finishing a project. Projects and tasks are a means to an end. Hands-on exposure to the issues and problems of distance-collaboration is a prime purpose of the course.

Communication and distance-collaboration raise further issues. The class of 2000 generated a joint virtual opera, *Phantom of the Internet*. There were complexities due to role allocation, schedules, and unequal workload; yet the final artefact (*http://hagar.up.ac.za/catts/learner/2000/opera/index.htm*) was a resounding success, as learners made contributions that synergistically capitalized on strengths - management, technical and multi-media skills, research, writing, etc. The groupsize of eight appeared to be cumbersome for distance teamwork, and the subsequent two-man co-operative tasks proceeded more smoothly.

At times interpersonal dynamics are stressful - in 1999 conflict arose between two learners, due to varying perceptions on the use of HTML coding. Acrimonious messages were posted on the mailing list, intimidating some students, who threatened to withdraw. The instructor *creatively* put the duelling students in a 3-person co-operative team with a mediator. They built a *Flames & Internet wars* website, using a *Calvin & Hobbs* theme to show how differing views cause conflict (*http://hagar.up.ac.za/catts/learner/projects/flames/index.html*).

Conclusion

RBO appears successfully to have simulated a real world class, its actions and ethos, in a way that creatively implements constructivist learning and distance-collaboration.

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Does Interactivity Influence Learning in Web-Based Environments?

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Abstract: This paper addresses the popular contention that multimedia-rich, web-based courseware increases learning. Research is reviewed that addresses issues relevant to interactivity and visualization from educational and human-computer interaction perspectives. The results suggest that some characteristics of multimedia may actually interfere with learning and should be taken into account by educators, designers and researchers when planning web based learning environments.

• Educational Research and Interactivity: A Retrospective

The proliferation of highly interactive and visually appealing educational multimedia and software, particularly in Web-based environments, reflects the prevalent belief that these features are associated with improvements in learning. Despite increasing commercial appeal, several basic research questions remain. Do multimedia-rich environments facilitate learning, and under what conditions? More specifically: Are increases in graphical and interactivity truly constructive in the sense that they facilitate learners' developing their own mental models of phenomena or do they merely present others' conceptualizations, providing learners with endlessly appealing graphics but little opportunity to puzzle out and form representations of their own? In this paper we examine these issues by providing a preliminary framework for examining the potential of interactivity and visualization devices in Web-based environments, both from educational and computer science perspectives. Iding (2000) derived principles for effective multimedia reflecting these theoretical perspectives relevant to the design of effective multimedia for learning science.

• Relevance to Web-based environments

Heightened interactivity appears to be implicit in constructivist educational models. However, these sorts of models need a means of measuring the students' ability to construct knowledge through interaction. Furthermore, is there any transfer from the training situation to the classroom situation? There is a fine line between formative evaluation of this type and research in that it is an iterative process. In the case of Web-based environments, assessment of learning needs to be redesigned to maximize the effectiveness of the learning environments because traditional pencil-and-paper type testing are not likely to at all tap into the kinds of representations that students may have developed. A primary consideration in the design of these environments for distance education is that interactions that are possible in regular classrooms are not available in distance education environments.

• Some Ideas from Usability Engineering

The field of human-computer interaction (HCI) offers examples of the application of psychology and computer science to the presentation and manipulation of information. There is particular interest in HCI applied to the development of educational software (Berg, 2000). Two of the many relevant examples are studies on the use of graphics and text in web pages, and expert-novice differences understanding visualizations of technical information. In particular, *usability studies* of web pages have implications for the design of web-based distance learning environments. Of the objects on a web page, users initial tendency is toward textual flags such as headings. Thus not only might designers of web-based courses pay particular attention to textual headings and captions, designers

should plan for students to switch focus among simultaneously open pages. Second, there is substantial computer science research on expert-novice differences both in general and specifically applied to visual representations of technical information such as schematic diagrams and visual programs (Petre 1995; Kiper et al. 1997). Diagrams are most commonly used in computer science to illustrate the structure of data or code (module interdependencies) or control (flowcharts). A common belief is that graphics and animation "must be better than text". Berg (2000, p. 363) echoes this optimism for animation: "effects such as animation can be very effective in establishing mood, in increasing sense of identification, for persuasion, and for explication." However, research comparing static graphics and text disputes common sense. Petre found that in graphics versus text tasks, subjects completed tasks more quickly when using text representations than using graphics. The illustrations were technical designs as Petri nets and schematic diagrams. Not only does it take longer to understand technical information presented as a diagram, novices are most negatively affected. Some expert-novice differences are remarkable – experts tended to use their fingers on the screen to augment their working memory. Novices lack skills in understanding their fields' conventions for illustrations, and they tend to be mislead by mis-cues. Novices' fledgling understanding of conventions and secondary notations cause not only mis-interpretations but also mis-production of technical diagrams. Petre suggests that a constrained environment that minimizes secondary notation might be better for novices

• Summary and Conclusion

In this paper, we began by speculating that the heightened interactivity and visualization capabilities afforded by multimedia and software in Web-based environments may not be consistently associated with learning gains, although they may be popularly presumed to be effective and are certainly commercially appealing. To determine the validity of this contention, we reviewed some of the educational, psychological and user modeling research that can relate to the design of Web-based educational environments. Results of this review indicate that interactivity and visualization, by themselves, may not be simple determinants of increases in learning and may under some circumstances, actually interfere with learning. Therefore, specific aspects of interactivity, as well as user characteristics and purposes, need to be taken into account when assessing and conducting further research on the efficacy of these features of Web-based environments.

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Investigation of the use of a Web Based Learning Environment for Emergency Department and Poison Information Centre Staff

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Abstract: The Emergency Department and Poison Information Centre have both been challenged with providing educational opportunities that will allow all staff to participate in the same experience. The very nature of the work in these areas, providing care for unplanned health events seven days a week, 24 hours per day, makes scheduling educational opportunities an exercise in frustration. To date learning needs have been addressed by planned face to face experiences that require the department to be "quiet" and the majority of staff to come into the hospital on their day off. Such efforts are often met with limited participation. All team members from both departments now have access to the world wide web through two terminals. An increasing number of team members also have internet access at home. Access, coupled with the availability of user-friendly authoring software to create web based learning environments, makes the web a viable option to present learning opportunities to team members. This present will describe the findings of a study examining the use of a web based learning environment as a means to increase access to and interaction in learning opportunities for Emergency Department and Poison Information staff.

Introduction

Participation in continuing education is a professional responsibility for all members of a health care team. However, health care professionals face unique barriers in participating in educational experiences that meets their learning needs. Focus on patient care in a hospital environment, shift work, personal and professional obligations outside of patient care and reduced education funding are just some of the challenges faced by learners in the health care field. Emergency care providers face additional challenges with the unpredictable flow of patients. Staff are often interrupted or unable to participate in scheduled learning sessions due to an unexpected crisis. It is generally impossible for health care teams to come together as a team to share knowledge and participate in discussion around patient care. Video recorded learning sessions and self-directed learning packages present possible alternatives. However, these modes of delivery present limitations. There is usually very minimal or no opportunity for collaborative learning through dialogue with peers or content experts. In addition, content is generally focused on objectives created by the presenter as opposed to the real needs or questions of the participant.

Constructivist learning theory provides a framework which challenges our current pedagogy. The framework identifies interactivity as one of the key elements in developing a successful learning opportunity (Jonassen, Davidson, Collins, Campbell, & Hagg, 1995; McVay, 1998). The learner must be actively engaged in the learning process, actively constructing their own knowledge as opposed to being a passive recipient of information. Interactivity incorporates three distinct components; learner-learner interaction, learner–content expert interaction, and learner- content/resources interaction. This type of a collaborative learning environment is key to the development of critical thinking skills essential for providing emergency care (Boyer, 1999). Constructivist teaching also places a strong emphasis on the learning needs of individual participants. Educational opportunities should be leaner focused as opposed to content driven.

Emerging informational and instructional technologies provide an alternative to the traditional mode of face to face delivery and hold great promise as a tool in a constructivist paradigm. This medium provides learners with an opportunity to not only selectively view content but also dialogue with their peers as well as local, national or international content experts. All participants can contribute to an asynchronous discussion on an electronic bulletin board contributing to the development of a collaborative learning environment. Several discussions can take place at the same time. Participants can choose any or all discussion threads depending on their individual need. Participants can also tap into any number of links on the web related to the topic of discussion. This type of a learning environment enhances the reflective process, allowing for constructive learning. This ability to engage in a discursive, adaptive and an interactive process provides the adult learner with a more meaningful educational experience (Driscoll, 1998).

The number and type of resources available to health professionals on the internet is on the rise (Pinkowish, 1999; Drake, 1999) Access, interactivity and learning outcomes have been the focus of many studies evaluating web based learning environments in formal academic settings (Ryan, Carlton, & Ali, 1999; Woo & Kimmick, 2000,). While there is a scarcity of evidence indicating the usefulness of this type of a learning environment to provide continuing education for interdisciplinary health professionals. Furthermore, there is no evidence pointing to the transfer of learning to practice from a web based environment.

Questions

1. Is a web based learning environment more accessible than a structured face to face session?

2.a Do participants feel they have a greater opportunity to interact with the content expert, peers and the content in a web based learning environment as compared with a structured face to face session?

2.b Do participants interact more with the content expert, peers and the content in a web based learning environment as compared with a structured face to face session?

3. Do participants feel that they learn as well in a web based learning environment as compared with a structured face to face session?

Method

This study was a randomized control study with the multidisciplinary staff members of the Emergency Department and Poison Information Teams (75 staff). Team members were informed of the purpose and nature of the study and interested participants were asked to complete a consent form. Participants were assigned a number upon completing the consent form and randomly assigned to a structured face to face intervention or a web based intervention. Randomization was facilitated with a computer generated table of random numbers.

During the month of August, 2001 Dr. Connie LeBlanc conducted a 45 minute face to face presentation on Street Drugs. The presentation consisted of an oral presentation with Power Point slides, with the opportunity to ask questions during and at the end of the presentation. Participants were asked to sign an attendance sheet when entering the room. Participants were also asked to complete a questionnaire immediately following the session which captured demographic data as well as satisfaction and self perception of interaction opportunities and learning.

A web presentation containing the same Power Presentation narrated by Dr. Ross was available two weeks following the face to face presentation. Participants were provided with an information sheet describing how to access and operate the website. This session was accessible to users with a valid password. Access to the site was available through computers in the Emergency Department and Poison Information. Participants with internet access at home were able to access outside of the Health Centre. The web site was built using web authoring software called WebCT with links to an electronic bulletin board for asynchronous discussion and external links to relevant internet resources. The site was accessible to participants for a three week period. A content expert checked the bulletin board twice per week for three weeks to address participant questions and correct any inaccuracies in the ongoing discussion. At the end of the three week period participants were asked to complete Questionnaire A as above.

Analysis

For the purposes of this study access was defined as the availability of the experience to the individual participant. It was represented by attendance at the sessions. Attendance at the face to face session was tracked using an attendance sheet. Access to the Web site was tracked using the electronic tracker built into WebtCT. All participants were asked to comment on accessibility to their assigned intervention in the post study Questionnaire

Interactivity was defined as the active engagement of the learner in the learning experience. Interactivity was measured on three levels; participant-participant, participant-content, and participant-content expert. A research assistant attended the face to face session and counted the number of participant generated questio ns as well as the number of participants who responded to content expert generated questions. A second researcher reviewed the audio taped session to validate the number of questions counted. In the web intervention an electronic bulletin board captured participant discussions. Transcriptions were reviewed and participant generated threads of discussion as well as participant responses to others (peers and content expert) were counted. WebCT also provided for tracking of participants viewing of content pages. Participants were asked to comment on the three levels of interactivity on Questionnaire A.

In keeping with the principles of adult learning and a constructivist paradigm, participants were asked to comment on their own level of learning during the intervention. This approach acknowledges that individual participants come to the intervention with varied educational and clinical experience and will identify their own personal learning outcomes for the event.

During this presentation we will describe the findings of the study as it relates to access, interactivity and learning in a health care environment. We will also describe the plan to incorporate expanded use of a web based environment to support learning and practice.

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The Web Project Readiness Checklist: Five Key Components That Must Be In Place for a Web Project to Succeed

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Abstract: The goal of this paper is to introduce a tool that will help you and your team overcome common problems that frequently cause web projects to miss deadlines, exceed budgets, or be put on permanent hold. Called "The Web Project Readiness Checklist," this planning tool is the outcome of over seven years of multimedia and web development work at The Ohio State University. The checklist was designed to expose and eliminate problems in five key areas before much time is invested in a project. This tool is most helpful for project managers or subject matter experts developing web-based learning applications that are new implementations of existing classroom curricula. However, if you are an experienced web developer you will still find the checklist useful, it will give you new ways to solve many of the difficult problems you have encountered in the past.

The goal of this paper is to introduce a tool that will help you and your team overcome common problems that frequently cause web projects to miss deadlines, exceed budgets, or be put on permanent hold. Called "The Web Project Readiness Checklist," this planning tool is the outcome of over seven years of multimedia and web development work at The Ohio State University. The checklist was designed to expose and eliminate problems in five key areas before much time is invested in the project. This tool is most helpful for project managers or subject matter experts developing web-based learning applications that are new implementations of existing classroom curricula. However, if you are an experienced web developer you will still find the checklist useful, it will give you new ways to solve many of the difficult problems you have encountered in the past.

There are five key components that, combined, form the foundation of any web development project: content, vision, insight, time and support. Technology is not included in this list because it is seen as the next layer, it is built on top of this foundation. When teams rush into planning, programming and designing without addressing fundamental questions, their projects become susceptible to the problems associated with weak foundations, namely rushing to keep things "propped up" when "cracks" appear, or watching projects collapse altogether. The common problems associated with these components include:

1. *Content* – The amount of content currently in hand, and the amount of content processing work that must be performed by someone with subject expertise is grossly underestimated.

2. *Vision* – The project vision is blurred or superceded by discussions about "cool" web gadgets (i.e. Flash movies), "innovative" instructional designs, and technology development/delivery issues. Yes, all of these things should be discussed but only after more fundamental vision questions have been answered. Otherwise, projects move in unproductive directions that ultimately waste valuable time.

3. *Insight* – The team does not review or critically evaluate other web sites that are similar in content or approach to the project at hand. Skipping this step results, again, in projects moving in unproductive

directions.

4. *Time* -- The amount of time required to develop the web application is vastly underestimated. Based on our experience, this is the number one cause of projects being put on permanent hold—a key member of the project team simply runs out of time and a competing priority takes over.

5. *Support* – Project "champions" do not have the support they need from those who control resources the project requires: content, staff time, funds, equipment, etc.

Laying a solid foundation: The Web Project Readiness Checklist

In order to eliminate the problems described above, our application development group designed the "Web Project Readiness Checklist" and we use it as a planning tool for every project request we receive. In our case, this checklist has helped many "champions" make the pragmatic decision to not proceed with their web project ideas after realizing the time and resources that would be required. Conversely, this same tool has enabled us to secure over $100,000 in recent funding because we had the evidence we needed to support our confidence the projects would succeed.

The checklist contains five items, each one with associated questions and tasks. Answer the questions and do the tasks. You will be amazed at the level of clarity your project will reach just by using this one simple tool.

☑ 1. You Have Content to Work With

What we mean by "have" is just that, "have," .... as in, "I have those 35mm slides in my course file," or "I have a VHS tape with that segment we'll use in my office." We do NOT mean "have" as in, "I have to write that part, but it's no big deal" or "we have to go out and shoot some footage, but it's easy, we can do it in a day."

"Have content to work with" means:

- 50-80% of the content you imagine will be a part of your program is in your possession (much of it will need to be edited and some of it will still need to be written, photographed, taped, etc.; the point is that most of it should already be in your hands)

- you own or your organization owns the copyright for the content OR

- you have or your organization has permission from the copyright holder to use the content in the program.

It is not necessary at this point to have the content in digital form, just keep it as it is for now--Microsoft Word documents, databases, spreadsheets, CAD drawings, glossy brochures, photographs, 35mm slides, video tapes, audio tapes or CDs, DATs, etc.

Before you check this item off as "done," clean out a filing drawer or a shelf or somewhere in your office and bring all of your existing content together. It doesn't matter if it is odd-sized, in electronic format or on 16mm film reels, just gather all of the content you will possibly use in your program and organize it in a way that is meaningful to you.

☑ 2. You Have a Clear Vision Of Who the Web Application's (Program) Users Will Be and How They Will Benefit From the Program.

Your answers to the following questions will help you clarify your vision for the project. Please go through them one-by-one and complete all of them before checking this item off as "done."

1. What three main problems are you solving by developing this program?

   Some kinds of problems might include: eliminating time and space barriers for users, enabling users to experience something that would be otherwise inaccessible to them (i.e., a simulation or "virtual tour"), making administrative data tracking of some kind possible and/or more efficient.

2. For whom are the problems being solved?

   In other words, who will your primary users be? Are they the company's employees? the school's students? the sales force? managers?

   Rule #1: "general public" or "all employees" is not specific enough, but "students in Arabic 101" or "all new-hires" or "women 18-24 with computers and internet access at home" would be specific enough.

3. Why are YOU solving these problems (emphasis on the "you")?

   Your job requires you to take responsibility for it? If you don't nobody else will? You think it will save time/money? You believe it will generate revenue? You have expertise and/or content that few others possess? You have funding to do "something" and if you don't spend the money now you risk losing it?

   It is important that you be honest with yourself here, it will give you clarity when we reach another item in the checklist about resources available to you. It is also important to keep in mind that technical skills have little to do with answering this question. If you are the world's expert on Japanese Noh Theater and you are frustrated by the lack of materials on the market that will help students learn about it, then this is a valid reason.

4. How will you determine whether the project has been successful?

   Your supervisor liked it and gave you a bonus? The web site was accessed by 4,000 employees in 6 days? You were able to demonstrate an impact on learning or an impact on the company's bottom line? Others working on similar projects hold yours up as an example of "best practice"?

5. How clear is your overall vision? The "elevator ride" test.

   Imagine you step into an elevator with a colleague, someone who could be a big supporter of your project idea, who says, "I heard through the grapevine that you have a new web project idea—what's it all about?" You have 30 seconds to explain your vision to him/her based on your answers to 1-4 above. What will you say?

   Rule #1: Write down your 30-second description and then say it aloud. Time yourself. Keep modifying the statement until you can say it in 30 seconds.

   Rule #2: In your description you must answer the questions: what problem is being solved, for whom, what's your role, how will you know whether it's been successful?

   Rule #3: You may NOT talk about the technology to be used in the program as a part of the description. Remember, technology comes AFTER the vision, it SUPPORTS the content and the message and, thus, must be chosen after decisions about the content/message have been made.

6. Now, go back to the previous item in the Readiness Checklist, "You have content to work with," and add or remove items to/from your pile of source materials --the one you've gathered in your office in a filing cabinet drawer or on a bookshelf--based on your refined vision.

☑ 3. You have seen how others have implemented similar projects and you have learned from their mistakes.

It is important to remember that developing any web application is a labor of love. It requires a lot of work on your part, not to mention your programming and design colleagues. Mistakes are costly in terms of time and resources. Know what you want, but also know what you DON'T want. Help your team understand your vision by SHOWING them examples and non-examples of it rather than just talking about it.

The best way to do this is to review similar multimedia products or web sites with a critical eye. Granted, there may not be another product on the market or on the web that is exactly like yours, but there are certainly ones that have features or content areas in line with your goals.

Your task is to *review five web sites and/or multimedia products* that have something in common with the vision you have for your project. Don't just spend a few minutes skimming them over, actually use each one to accomplish something: buy something, learning something, find something, use the site/product to accomplish something for which it was designed.

Spend 30 minutes reviewing each site/product:

- 10 minutes jumping around in the program to gain a bird's-eye view of it
- 10 minutes working through a specific task (if it is a shopping site, buy something; if it is a learning application, go through a lesson; if it is a digital library, find a resource of interest to you)
- 10 minutes answering the following questions about the site:

    1. Who do you think the intended audience is for this product? Try to find some kind of overview or introduction and read it to help answer this question.
    2. What problem do you think the program is attempting to solve for them? Look at the way the program is structured, the kinds of input requested from users and the feedback provided.
    3. What are 3 things you like MOST about this site/product? Why?
    4. What are 3 things you like LEAST about this site/product? Why?
    5. If you were the person in charge of revising this site/product, what 3 things would you do differently in the next version that would make it really useful?
    6. What does this site/product have in common with the one you aim to develop?
    7. How many people participated in the development of this site and what were their roles? Try to find a credits screen somewhere on the site.

Once you have reviewed five similar multimedia web sites/products, go back to the previous item in the Readiness Checklist, "You have a clear vision of who the program's users will be and how they will benefit from the program," and modify your 30-second description, if necessary.

☑ 4. You Have Enough Time to Work on This Project

In our experience, lack of time is the number one reason projects get put on permanent hold. It is crucial to be realistic about your expectations for the web application, as well as your level of commitment to the project.

1. What is the release date for this program, or the deadline for the "final" version to be ready?

2. Between now and the release date, how many hours per week can you personally dedicate to this project? In our experience the minimum is 10 hours per week, preferably 25-30.

3. Who else might be able to help you with this project and in what capacity, and how many hours per week can each person dedicate himself/herself to it between now and the release date? Don't assume—ask each person!

4. Between now and the release date, are there any major events happening in your life or the lives of those above that will put this project on the back burner (i.e., major holidays, someone gets married or buys a house, you move offices, you must prepare for end-of-quarter reports, a big training event or conference presentation to prepare for...)?

5. Given the hours you are available, the people/groups that may be able to help, and the range of block-out dates between now and the release date, are you confident you can get this project done on time? If yes, check this "readiness" item off. If no, what additional staff and/or time would you need?

☑ 5. You Have Support for This Project

- Someone influential supports your goals and vision without reservation. This could be your supervisor, your unit/division vice president, your publisher...someone who has the power to keep your project moving ahead or to block it.

- You have funds to work with and some level of autonomy in allocating those funds.

- You have resources to work with including some equipment, software, people, content and time. Even if you decide to outsource the technical production work, you will still need enough equipment/help to work effectively with the production team (i.e. TV/VCR to review video-based segments that will ultimately be digitized; color printer to print scanned images for notations, someone to help collate and organize all the content, etc.).

To Begin or Not to Begin: Interpreting The Results

Congratulations! Through a few hours of work you have hopefully gained a new level of clarity in thinking about your project. If you were able to meet all the requirements and check each item off, then move ahead into the exciting and exhilarating design phase. If you have four of the five items in place, still move ahead but be sure to complete the last item before getting to deep into design. If you have three or fewer of these items in place, it would be best to not begin the project right now. This does not mean the project should never be done, it just means you need to make some additional arrangements before it can get underway.

How did The Multimedia Readiness Checklist work for you? Please help us refine it by sending your comments, suggestions and examples to Diane Dagefoerde, dagefoerde.2@osu.edu.

Procedural Terrain Visualisation for Internet-Based Games

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Abstract: In this paper a method is presented for dynamically generating landscapes in Internet-based games and other graphics simulations. Current systems that use large datasets to represent the terrain have a number of drawbacks including large storage requirements, low level of detail and overcrowding in multiuser games. Here an approach is described in which the terrain is procedurally generated as required. The terrain is produced in the form of blocks and displayed using a spherical page management technique. This approach allows for the generation of a detailed environment, participation by a very large number of players in multiplayer games and easy download of the environment generator via the WWW.

Introduction

Terrain visualisation typically renders a dataset that represents a terrain. These datasets consist of height values sampled at regular grid intervals. By constructing a lattice in three-dimensional space, and using the values in the datasets to displace the intersections of the lattice, a renderable mesh of triangles is created.

Creating landscapes based on large datasets results in a number of limitations for games applications including: (1) in multiplayer games the environment quickly becomes overcrowded when more than a dozen or so players join; (2) these environments demand a lot of storage space and they are usually distributed by CD ROM rather than via the WWW; (3) in order to display relatively large terrain areas and to maintain reasonable display rates the detail must be kept within certain limits; (4) user/player participation is reduced because the environment cannot be downloaded via the WWW.

The main problem with the use of simple triangular meshes is the large number of triangles involved. Modern hardware is not capable of rendering in real time the amount of triangles necessary in a mesh to accurately depict a landscape over a reasonably large area. Many present solutions to this problem involve rendering only objects that are close to the user's position and using a fog effect to hide the missing detail. Another common solution is to decrease the resolution at which the terrain is sampled and hence produce a larger, less detailed mesh. Lindstrom et al (1997, 1999) developed techniques for creating meshes that involved different triangle sizes. These meshes use smaller triangles near the user's viewpoint where detail is important, and larger triangles at areas distant from the user. These are known as continuous level of detail meshes, abbreviated to CLOD, or, more commonly LOD meshes.

Page Management Approach

The approach presented here is based on the assumption that the terrain to be visualised is a terrain of fantasy, one that does not exist in real life. The solution involves the creation of a viewing system that procedurally generates all the graphics that are to be displayed in real time. The terrain is created only around the user's position.

To maintain a terrain around a user's position the terrain is created in small blocks. These blocks, referred to as terrain pages, join together to form the terrain the user sees. A page management approach is used to display these blocks as required. The advantage of this paging approach is that as the user travels across the landscape new pages can be created and added. This is considerably faster than reproducing the entire scene around the user's point of view. The work presented here involved developing and implementing methods for (1) creating the terrain blocks and (2) performing the page management. The terrain blocks are created from height field data and level of detail (LOD) algorithms. The page management system is based on a spherical page wrapping approach.

The goal of a LOD algorithm is to simplify the landscape mesh in appropriate places so as to reduce the number of triangles used while maintaining the quality of the scene as much as possible. The LOD algorithm devised for this work is based on an adaptive quadtree refinement algorithm (Wright, 2000). This recursive

algorithm utilises a data structure that stores a square that is optionally made up of four other squares which in turn are optionally made up of four other squares.

The approach to page management is termed the spherical offset method. It is named thus because of the manner in which pages are wrapped (as if the terrain forms a planet). This novel approach is very efficient and produces very good results. A map represents an entire landscape and a submap represents the user's visual vicinity. The LOD algorithm operates directly on the submap and the terrain is produced as a collection of tessellating pages. As the user moves a distance equivalent to one page the submap is adjusted around the user's position. New pages are created as the user comes within viewing distance of them, and, pages are removed as the user moves away from them. It is important to note that the user moves across the submap rather than remaining centred in the submap with the pages changing.

An example of a user moving to the right is shown in Figure 1. As the user moves from square 5 to square 6 new pages are loaded into 1,4 and 7. The user can always see one page ahead. As the user moves off square 6 he/she moves onto square 4 which is displayed in front, i.e. the view has wrapped around to the other side of the submap.

User at initial position *After movement 1 page right.* *After moving another page right.*

Figure 1: Spherical offset page management

The page swapping in this spherical offset page management technique is highly efficient. It is the efficient page management and the easy integration with the other components of a terrain simulation that make this approach to terrain visualisation highly desirable.

Conclusion

An approach is described here for producing a graphical simulation in which the virtual environment is continuously produced without the need for a large terrain dataset. At all times the environment is procedurally generated in correlation with other users.

This technology allows for graphically intensive Internet-based games and virtual environments to be downloaded easily. The approximate download size is 1-2 Mbytes as opposed to current systems that can be in the order of many hundreds of Mbytes. This easy distribution of the virtual environment encourages user participation.

The constrained size of current environments limits the number of participants in multiuser games. Simulations using the methodology described can be extremely large in size and allow thousands of players to participate without overcrowding.

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Quality in Distance Education

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Introduction (Gordon Davies)

The discussion last year at the annual convention of the American Federation of Teachers and the subsequent resolution that was passed highlights the concern felt by many about the quality of distance education programs. There are many who feel that the quality of the teaching, the support that students receive and the information provided to students is not as good in a distance education environment as in a conventional face-to-face situation.

The panelists come from varying backgrounds, coming from a variety of academic institutions and industry. The panelists will explain how quality is assured at their institutions and claim that students who do learn at a distance receive as good an education as those in the face-to-face environment. Evidence to justify the claim will be produced. Factors such as the cost of the provision and the scalability of the operation are factors that will also be discussed.

C. Fay Cover

Distance Education, The web, Industry based competencies and fundamental knowledge, can they all be achieved while maintaining quality? As we embrace the World Wide Web and the associated technology, ensuring that we have enhanced student learning and met all course objectives can be a daunting task. Can we make it work? For example, one concern is centered on how to provide the appropriate interaction with the professor and other students. Exploring a variety of technologies being used today by various educational and industry alliances. The quality of distance education depends upon a variety of factors, such as; technologies used, professor training, reliability of the equipment and data communications networks, and many others. Finding the right mix and delivering up-to-date curriculum is a challenge that can be overcome.

Wendy Lawrence-Fowler

At the University of Texas-Pan American, we deal with quality in three aspects of distance education: the quality of course materials, the quality of presentation, and the quality of student services. While we address each aspect independently, we also try to capitalize on the synergistic interplay among the aspects. It is this synergy that defines the quality of a program and can be evaluated via the outcomes of the learning experience.

We use an approach to course materials development that matches the faculty member's level of expertise and comfort with technology, as well as their teaching style, to the level of development support provided by the Center for Distance Learning. Support levels range from the Center simply providing server space and maintenance to a level, which entails a team of

individuals including a faculty content expert, an instructional designer, a media specialist, a graphic designer, and one or more courseware technology assistants. The Center also provides training for faculty in both technological and pedagogic issues (including an online course titled "Teaching Online in Higher Education") and provides a rubric which faculty use to complete a self-assessment of their course materials.

The training and rubric help faculty match the presentation of the materials they develop with their preferred interaction or presentation style. Presentation style and course materials are tested at three levels: first the materials are used to augment the traditional classroom. As material design and presentation are honed, the faculty moves to what we refer to as a reduced seat time course (traditional seat time is traded for web based learning experiences.) Given that the materials and presentation meet a strict set of standards, including the application of sound online pedagogic practices, the course is taught completely in a web-based environment.
Various factors are tracked to evaluate a course or program including short-term and long-term outcomes (retention and satisfactory completion, performance in subsequent courses, and job placement).
Finally, the Center for Distance Learning provides online and dial-in helpdesk facilities for students. Through the University of Texas System and a consortium of Hispanic serving institutions (HETS), distance learning students are provided access to web-based information/library resources as well as advisement and mentoring programs.

I will talk more specifically about our training programs for faculty, the rubric used for evaluation of materials and presentation as well as the challenges of providing students support services to the distance student .

Mark Guzdial

The Role of Technology in Distance Education

When people say "Web," there's often a reaction of "Distance Education!" as being a potential killer app. Yet, many large-scale distance education efforts rely much more on paper and less on Web-based or other computing technologies. Some of the problems of current technologies for distance education include cost, lack of robustness at large scales, and inferior quality and educational effectiveness compared to other technologies. For example, we know that lectures are among the least effective educational interventions, and putting lectures in a postage-stamp size streaming video window certainly doesn't make them better. At the same time, there are opportunities for computing and network technologies to help solve problems in distance education that paper can't solve alone, like having a mentor handhold a student through a difficult problem, or working through multiple iterations of a design in a studio environment. Finding the right role for the right technologies in distance education is an open problem. when marking more traditional assignments.

AHA! Adaptive Hypermedia for All

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Abstract: There are roughly two types of (Web-based or other) Adaptive hypermedia systems (AHS): *special-purpose* systems, geared towards one specific application or application area, and *general-purpose* systems, designed with different applications in mind. Most existing systems are *special-purpose*, with a majority aiming at educational applications. Previous developments on the AHA system (De Bra & Calvi, 1998) and the AHAM model (De Bra et al, 1999) have shown that *general-purpose* AHS can be designed and implemented, but also that such systems tend to be too complicated for non-technical authors. This paper describes the "third generation AHA", called Adaptive Hypermedia for All, which is being developed as an open source project sponsored by the NLnet Foundation. AHA aims at bringing adaptivity to all kinds of Web-based applications, through a simple but powerful adaptive engine. In this paper we focus on the authoring interface for creating the conceptual structure of an adaptive application. But we also briefly describe how the AHA system can be used for some typical constructs found in (adaptive) Web-based applications.

1. Introduction and Background

In (Brusilovsky 1996) an overview is given of adaptive hypermedia systems (AHS) and of the methods and techniques these systems employ. In 1996 many AHS were not yet Web-based. Most were stand-alone (or locally networked) software systems aimed at a single *specific* application or application area, such as learning or information retrieval. Virtually all newer AHS are Web-based but still serve a single application area. This has important advantages: 1) A *special-purpose* AHS can be made easy to use for an author, through an authoring interface that is tailor made for the designated application, and 2) the interaction with the end-user can be optimized through a well-designed browser interface. A prime example of such a system is Interbook (Brusilovsky et al, 1998), a tool for creating adaptive textbooks. It offers users a frames-based presentation that includes a partial (and adaptive) table of contents, an overview of required prerequisite ("background") knowledge for the current textbook page, and an overview of "outcome" knowledge (concepts to which this page contributes). It offers some special features for learning as well, including a glossary and a "teach me" guided tour generator to learn about a specific concept. The special features of Interbook for educational applications may not be desirable in other application areas such as an adaptive search engine, on-line information systems (or information kiosks), on-line help systems, corporate websites, shopping sites (mail order catalogs), etc. The AHA project aims at creating a Web-based environment for creating very different types of adaptive applications.

Authoring usable hypermedia documents (Web-based or not) is always difficult. On the one hand an author wants to offer a lot of navigational freedom, with short paths to every page. But on the other hand an author wants to avoid overloading the user with too many links, which would make the selection of appropriate destinations difficult. Many adaptive hypermedia systems (AHS) tackle this problem by automatically selecting or emphasizing those links that are considered "appropriate", based on a model of the user's state of mind. Similarly, an author also wants to provide the "appropriate" information on each page, thereby including prerequisite explanations for users who need them, by providing additional information for the truly interested user, etc. See (Bruvilovsky 1996) for a long or (De Bra et al, 1999) for a short overview of AHS techniques. Such *personalization* is beginning to appear on websites, usually through a *My* suffix (like in "My Yahoo!", "My Excite", "myCNN.com", etc.). However, in most cases the personalization is based on a user profile that is created through an elaborate registration process, and not adapted to the changing interests and knowledge of the user that can be seen by observing the user's browsing behavior. The goal of the AHA project is to create a simple environment for making websites that adapt themselves to the user. It builds upon the adaptive engine in the AHA system (De Bra & Calvi, 1998, De Bra et al, 2000).

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The structure of this paper is as follows: in Section 2 we show the overall architecture of the AHA system. We explain the role of the different structures that together provide all the information the adaptive engine needs to perform adaptation. In Section 3 we show how an author can create and manipulate the conceptual structure of an adaptive application, and how web-pages are linked to that conceptual structure. Section 4 shows examples of common navigation structures seen in (adaptive) Web-based applications and how these can be realized using AHA. The final section indicates the planned future stages of the AHA project.

2. Architecture of the AHA system

The overall architecture of AHA is inspired by the AHAM reference model (De Bra et al, 1999), an extension of the Dexter model (Halasz & Schwartz, 1994). This model was constructed to capture the structures and functionality of most existing (and future) AHS. In this model an AHS consists of four parts that work closely together:

- The *domain model* describes the application domain in terms of *fragments*, *pages* and (abstract) *concepts*. In the AHA system pages are simple XML files containing fragments of HTML text (possibly with embedded images, JavaScript, etc.). XML tags are mainly used to delimit the boundaries of the fragments and to provide *conditions* on the inclusion of fragments. (We shall briefly describe these conditions later.) Pages are connected through hypertext **links**, using the HTML *anchor* tag (<A>). In AHA pages are at the bottom of a *concept hierarchy*. (In the full AHAM model the fragments are at the bottom.) In Section 3 we describe how the concept hierarchy is visualized in the authoring interface. Pages and higher-level concepts are also connected through **generate** and **requirement** relationships that play an important role in the processes of *updating the user model* and *performing the adaptation*. (See below.)
- The *user model* in AHA mainly consists of a table with for each page or concept an attribute value that is updated when the user browses through the Website. The updates are partially determined by the **generate** relationships. Currently for each concept AHA maintains an integer attribute with a value between 0 and 100. (Different attribute types are planned for the future, but for the most part having 101 possible different values for each concept is more than enough.) When a user accesses a page there are two possibilities:
    - If the page was *desired* (according to the requirement relationships we describe later) the attribute value for the page is increased to 100. In a learning context this means that the system thinks the user has full knowledge of this page.
    - If the page was *not desired* the attribute value is increased to 35 or left unchanged if it was already 35 or higher. This value 35 was chosen arbitrarily. In a learning context it represents that when a user reads a page for which the system thinks she is not (yet) ready, she only gains partial knowledge of that page.

  Updates to (the attributes of user-model) concepts are propagated to other concepts through the **generate** relationships. For each (page or) concept there is a list of relationships with other concepts. The relationships also have attributes associated with them that indicate how an update to the "source" concept's value defines the desired update to the "destination" concept's value. The update can be the assignment of an *absolute* value to the destination concept's value, but it can also be a *relative* update, meaning that a fixed *percentage* of the update to the source concept's value is propagated to the destination concept's value. In AHA all generate relationships for one concept are grouped into a structure like the following:

```
<genitem>
        <name>de_koninck</name>
        <item concept="belgian_beer" absolute="no" perc="10"/>
        <item concept="alcohol" absolute="yes" perc="5"/>
        <item concept="chocolate" absolute="no" perc="-3"/>
</genitem>
```

  A possible interpretation would be that the system's confidence that the user is interested in Belgian beers increases by 10 when the user visits the "de_koninck" page (assuming that in the user model the value for de_koninck goes from 0 to 100). The system's confidence that the user is interested in chocolate decreases by 3. The system also registers that the user is accessing a page on beer with 5% alcohol. This information can be used to conditionally include information in other pages, specific for beers with 5% alcohol content.

  The way updates are implemented in AHA allows the further propagation of *positive relative* updates, such as the one for "belgian_beer" (De Bra et al, 2000). This is useful to allow an interpretation of the user-model values as *knowledge*. Reading pages contributes to the knowledge of a section, which contributes to the knowledge of a chapter, etc.

- The *adaptation model* is a part in the AHAM model that is defined as a collection of rules that define how the adaptation must be performed. (Strictly speaking in AHAM the rules we described above for updating the user model through the generate relationships also belongs to the adaptation model.) In AHA the adaptation is defined through **requirement** relationships. For each fragment, page or concept we can define a relationship that indicates under which circumstances this fragment, page or concept is *desired*. Such a requirement relationship links the "source" fragment, page or concept to one or more "destination" pages or concepts. Whether or not a fragment, page or concept is *desired* may not only depend on which information the user has read before, but also on which information the user has *not* read. (All user-model values are initialized to 0.) In the current AHA system for each (fragment, page of) concept there can be one requirement relationship, written as a Boolean expression in (user-model) pages or concepts. The requirement relationship for a fragment appears in the XML/HTML page that contains the fragment. Requirement relationships for pages and concepts are stored together in one XML file (typically named "xmlgenlist"). In the previous (non-existing) Website on Belgian products we can imagine a paragraph (fragment) describing special characteristics of beer with more than 10% of alcohol, and which is aimed at people who have shown great interest in the topic of beer. The Boolean expression for the requirement relationship for this paragraph could then be something like:

  belgian_beer > 70 and alcohol > 10

  As this example already shows that the simple user-model structure with just one (bounded) integer attribute per page or concept already enables the creation of adaptive applications based on knowledge (0 means *unknown* and 100 means *well known*), interest (by reading different pages on beer the user expresses her interest in the topic of beer) or anything else that can be expressed through a number (or an enumerated type simulated through numbers).
- The final element in the AHAM model is the *adaptive engine* that performs the actual adaptation. While the adaptation rules indicate the *desirability* of fragments, pages and concepts, the engine generates the pages in such a way that the user can distinguish desired from undesired information. Many techniques for adapting page content and link presentation exist (Brusilovsky, 1996). The AHA system currently uses the following techniques:
  - *Conditional inclusion of fragments*: desired fragments, i.e. fragments for which the *requirement* Boolean expression is true (or for which there is no condition) are included in the page; undesired fragments are omitted.
  - *Hiding or annotation of links*: AHA presents link anchors as colored text (not underlined). AHA uses three link colors: "good" for links to previously unread desired pages, "neutral" for links to desired pages that were already read, and "bad" for links to undesired pages. The default colors for "good", "neutral" and "bad" are blue, purple and black. Assuming that normal text is black this color scheme corresponds to the technique of *link hiding*: links to undesired pages are present (and fully functional) but not clearly visible. In AHA the user can change the color scheme. Another well-known color scheme, used e.g. in Interbook (Brusilovsky et al, 1996, Brusilovsky et al, 1998) uses the traffic light metaphor: green, yellow (or orange) and red. Such a scheme results in the technique of *link annotation*. (Interbook uses other annotations in addition to this.)

AHA supports "pure" Web-based applications. On the server side the adaptive engine consists of Java Servlets that are activated when the Web-server receives HTTP requests from the browser. Whenever the user clicks on a link the requested page will be "filtered" by the adaptive engine and the user-model will be updated by taking into account the page visit (and the associated generate relationships). Requests may also be generated through JavaScript code that is embedded in the HTML pages, e.g. for updating Web-pages that consist of several frames. For the AHA engine all these requests are treated equally and handled separately. It is thus possible to create frames-based as well as non-frames-based applications with AHA. AHA is also a "pure" Web-based system in the sense that it *only* reacts to HTTP requests. There are no special tools or protocols to interact with the adaptive engine, no user-model updates based on timeouts, etc. AHA can be installed on any Web-server supporting Java Servlets. (Currently we have a "production" version running on W3C's Jigsaw server and on Sun's JSWDK and are experimenting with the emerging Servlet support on the popular Apache server.)

The architecture, and even the current implementation of AHA is sufficiently powerful to support a wide variety of adaptive Web-based applications. We show parts of a few possible examples in Section 4. The biggest shortcoming until now has been the lack of authoring support. In the next Section we discuss the automatic generation (and maintenance) of the XML file(s) that represent the conceptual structure of an application, from a user-friendly and (partially) graphical authoring interface.

3. The authoring interface

In order to develop any non-trivial Web-based application one needs to first design (or "draw") the overall conceptual structure. Traditionally, in hypertext applications, a "conceptual" diagram shows how pages are connected through links. The link structure normally contains a *hierarchy*, which corresponds to a book structure (with chapters, sections, subsections and paragraphs), some special structures such as table of contents, index and glossary, and a set of carefully chosen cross-reference links between pages. See e.g. (Botafogo et al, 1992) for an article on metrics for link structures. Many Websites even offer the hierarchical part of the link structure as a navigation aid for end-users, through a so-called *site map*.

For an adaptive application (at least when developed for AHA) one needs to consider not only the **link** structure but also the **generate**- and the **requirement** structures. In this paper we concentrate on the creation of the **generate** relationships. (The creation of link structures is well known, and the requirement structures can be pretty arbitrary. We plan to study special types of requirement relationships such as *prerequisites* later.)

In most cases the application domain will have some kind of hierarchical structure. Figure 1 shows a small part of such a structure, from our imaginary Website on Belgian products. Such a hierarchy normally corresponds to generate relationships that have a positive, relative value. Reading about "de_koninck" shows interest in beer and also means you learn something about beer. Learning something about beer means you also learn something about Belgian products. And learning about Belgian products means you're learning something about Belgium. To keep the overview simple and readable the graph does not show the *percentage* of each generate relationship. The interface shows the percentage when you move the mouse over the icon that precedes the concept name.

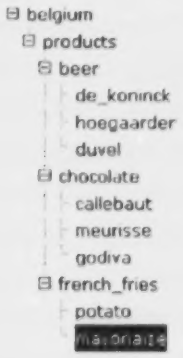

Figure 1: concept hierarchy shown through generate relationships

When building an application the other, more arbitrary generate relationships must also be entered, and can be shown in the same graphical way. Figure 2 shows the generate relationships between different beers and the concept "alcohol". To indicate that the concepts "de_koninck", "hoegaarden" and "duvel" have a hierarchical and therefore prime place somewhere else in the graph their names are preceded by an icon like that for a windows "shortcut" (equivalent to a Unix symbolic link).

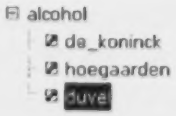

Figure 2: structure of positive and negative generate relationships

Figure 1 can be extended with negative relationships from the different beers to the concept "chocolate" and negative relationships from the chocolates to the concept "beer". Reading about "de_koninck" not only increases the interest (and/or knowledge) in beer but also decreases the interest in chocolate. If both updates would propagate then "products" would receive a positive update through beer and a negative update through chocolate. This is clearly not a desirable situation and explains why the AHA system does not propagate negative updates.

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The graphical overview in the authoring interface shows a *top-down* view on the generate relationships. Using the book metaphor the top-level element will be the book, with the chapters at the next level, then the sections, etc. This metaphor is so common (especially since everyone knows the Windows Explorer) that we expect authors to easily understand these overviews. For defining the generate relationships however we take a *bottom-up* approach. When an author enters a concept (or page) into the structure he must specify the influence of this concept on other concepts. Using the book metaphor again, when entering a subsection the author identifies to which section it belongs. When entering a section the author says to which chapter this section belongs, etc. Therefore we have created an authoring interface for entering the generate relationships for which the given concept is the source. Figure 3 contains (part of) the interface that shows the generate relationships for "de_koninck" in our imaginary example. Each time the author adds or updates generate relationships the graphical (explorer-like) presentation of the overall structure is updated accordingly.

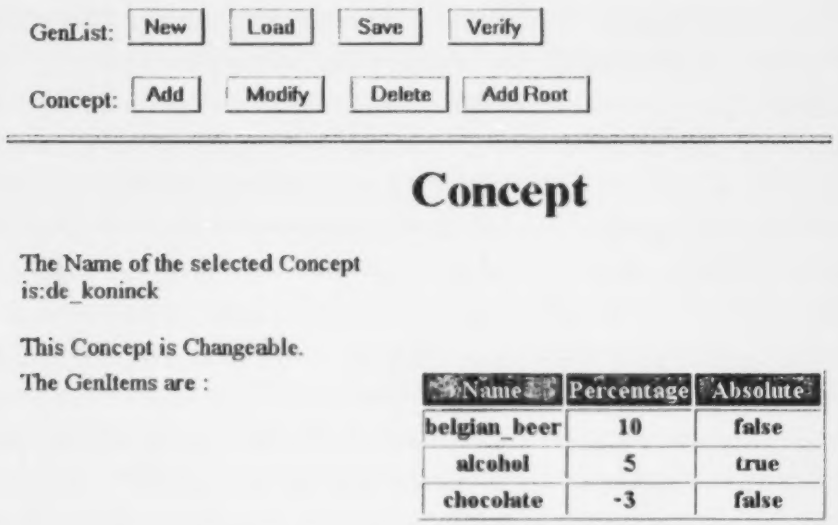

Figure 3: interface for entering and updating generate relationships

The first entry in the table in Figure 3 is interpreted as the hierarchical position of the concept. So it is the order of the items that determines where "de_koninck" is shown with and where without the "shortcut" icon. And in case there is a cycle in the generate relationships the order in which the concepts were created determines which concept gets the highest position in the hierarchy.

Figure 3 also shows another feature of AHA: for each concept the author can indicate whether or not it is "changeable". The user of an AHA application can manually alter the user-model by means of a form. For each concept the author marked as "changeable" the user can view and alter the value in her user-model. We realize that adaptive Web-based applications can only work with unreliable input (the page requests made by the user), and therefore it is best to allow end-users to manually update (or "correct") their user-model.

4. Examples of AHA applications

In this section we briefly indicate how to realize some common constructs using the AHA system. We first look at the most popular application area for AHS: learning by reading, and possibly verifying knowledge through multiple-choice quizzes. The author must decide for each page how much knowledge it contributes to each course topic. This determines the *percentage* to use in the generate relationship that links pages to topics. In order to allow users to skip parts of the material the author can choose the numbers such that reading most (but not all) pages about a topic already results in 100% knowledge. Topics can be grouped into larger units, and knowledge of topics is accumulated in the larger units because AHA propagates positive relative updates.

The AHA system contains a module for multiple-choice tests. That module allows for randomized tests that make cheating somewhat difficult and that are thus suitable for student evaluation. Simple fixed multiple-

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choice quizzes can be created in plain HTML by using links to pages that explain whether an answer is right or wrong. When the user chooses an incorrect answer, the answer-page can explicitly decrease the knowledge value for some topics and reset the value of pages that must be reread to 0. When the user reads the material again knowledge about the pages and topics is augmented again.

Another popular construct is that of a "table of content" frame, showing a menu and possibly also one or more submenus. Basically, this *navigation frame* acts like the left frame in the Windows Explorer. Submenus can be opened in the navigation frame, or when a page that belongs to a different submenu is opened by clicking on a link (anchor) in the *information frame*. The (sub)menus in the navigation frame can be implemented as conditional fragments. Each menu is assigned a unique number, and a global "concept" *menu* must be defined. Each page is connected to the appropriate menu by adding a generate relationship between the page and the *menu* concept. This generate relationship must define an *absolute* update to the number of the (sub)menu that must be opened when this page is displayed. Whenever the page is loaded in the information frame the *menu* concept is set to the correct value. A one line JavaScript program in the HTML page can instruct the browser to reload the *navigation frame*. Because the request for the page precedes that for the menu the menu is retrieved with the appropriate submenu opened up. Such Explorer-like menus are used in our on-line course text about graphical user-interfaces, at http://wwwis.win.tue.nl/2R350/. (The whole system is so fast that you hardly notice that the menu is refreshed *after* loading a page and not *simultaneous* with loading the page.

A final example is that of verbosity levels. In the same course on graphical user-interface, there is a one-to-one correspondence between the Webpages that are available for the students and the viewgraphs that are used during the lectures. The same topics are treated and the overall style of the presentation is the same. But for each item the on-line text is much longer than the one-liners on the viewgraphs. The pages and viewgraphs are always in sync during updates to the course because they are actually the same pages. A global "concept" *verbose* is used to guide the conditional inclusion of fragments. In the course only the levels 0 and 100 are used, but by using more values one can create a Web presentation that exists at different levels of verbosity.

5. Conclusions and Future Work

Web-based adaptive systems need not be geared towards a single application or application area. AHA (the Adaptive Hypermedia Architecture) was originally built to make an on-line (hypermedia) course adaptive. For this purpose a user-model was introduced with for each page (or concept) a knowledge value. We soon realized that there was nothing in the way AHA treated this knowledge value that actually required the value to represent knowledge. We have developed applications (and shown examples in this paper) in which the AHA engine performed arbitrary types of adaptation based on the user's navigation (De Bra & Calvi, 1998). In this paper we have presented (most of) the interface for creating and manipulating the *generate relationships* that define how user actions result in user-model updates (and thus indirectly also in adaptation that is based on the user-model). We continue to improve and extend the functionality and usability of AHA, especially for authors, through a research grant of the NLnet Foundation (see www.nlnet.nl). In this AHA project (or Adaptive Hypermedia for All) we are developing open source software that will be made available from our Website http://wwwis.win.tue.nl/. (Preliminary software is already available at this time and we welcome feedback.) Among the planned developments are analysis tools for detecting potential problems with the *link*, *generate* and *requirement relationships*. These tools will warn an author about pages that never become *desired*, or that can never even be reached, fragments that are never included, etc. Apart from improving the usability for authors we will also create more applications using AHA in order to be able to evaluate the user acceptance of adaptive Websites in general and adaptive AHA applications in particular.

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Adaptive Web-based Textbooks

(panel)

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Discussion Topic

Hypermedia systems have enabled authors to break free from the linear presentation structure enforced by the world of physical (paper) books. The Web has further enabled authors to bring hypermedia documents on-line, so that they can reach a much wider audience. As a consequence, documents also reach an audience with widely varying interests, background, (hypermedia) experience, etc. In order to provide the most appropriate information to all users, and present it in the most suitable way, documents must be *adapted* to target user groups or even individual users. Adaptive hypermedia provides the methods and techniques to perform this adaptation automatically (instead of purely based on a questionnaire to be completed by every user).

Adaptive hypermedia has been applied in many application areas, but a large majority of all adaptive hypermedia applications is used in education. While it is not often named as such, most learning material that is available on-line can be viewed as an extension of the concept of a textbook. (Extensions may include search facilities, automatic evaluation of exercises or assignments, progress feedback, etc.) The panelists have all been involved in the creation and use of *adaptive* on-line textbooks. The panel discussion focuses on the experience with different adaptive methods and techniques used in these applications. Experience with a single specific adaptive application cannot lead to conclusions that are guaranteed to carry over to a different application area or the use by a different type of audience. Therefore the aim of this panel discussion is to find common experiences that suggest a more generally applicable pattern (that should be verified through future research) as well as contradicting experiences that suggest that the perceived influence of adaptation might actually be something that was specific to the application area, the audience, or the course topic. Although the four panelists together will present different angles of adaptive textbook creation and application, active participation of the panel attendees is needed to collect and discuss more different experiences with adaptive educational course material. Because the WebNet conference proceedings are produced in advance, the outcome of the panel discussion, including the expected participation of the audience, cannot be included here.

Background: Methods and Techniques for Adaptive Web-based Textbooks

Most textbooks have a structure that appears to be hierarchical (with chapters, sections, subsections, etc.) but that also provides one clearly suggested reading order. Of course it is possible to dive right into chapter 4, but most readers will not be surprised when this chapter uses terms and concepts they are not familiar with. The reader will automatically assume that the difficulty in understanding chapter 4 is caused by not having read chapters 1 through 3 and that it is really the reader's fault. Very few people expect a textbook to be clear for readers who ignore the suggested reading order. Learners have very different expectations from a hypermedia or Web-based textbook. When the reader sees a table of contents in which chapter and section titles are links, he or she expects that the author has intentionally made these links available to enable users to start (or continue) the reading process in any desired chapter or section. This not only sounds but actually is too good to be true. It is virtually impossible to write a textbook in which the chapters and/or sections can be studied in any arbitrary order. And in a rare case where it would be possible, it is certainly a lot of work to write the textbook with many different reading orders in mind. Adaptive methods and techniques come to the rescue. An Adaptive Web-based textbook can monitor what the learner reads, possibly also which tests or assignments the learner completes, and can adapt the presentation accordingly. This adaptation is generally done in two ways:

- **Adaptive presentation:** the information and/or the way it is presented is adapted to the user. When the system notices that the user visits a page in which a concept is used that the user does not yet know about, it may insert a (short) explanation to compensate for the missing foreknowledge. This adaptation method is sometimes referred to as adding a *prerequisite explanation*. Likewise, it is possible to provide an *additional explanation* of certain details to advanced users, or to show a *comparison* with other concepts, for users who are already familiar with these other concepts. Different techniques are used to create adaptive presentations. A simple technique is to use variants of information pages. Unfortunately this leads to duplication of the information that is common to each variant. An alternative technique is to use conditionally included fragments. For the inclusion of additional details one may also opt to always include the material but "shade" it for users who should probably skip these details. Techniques are plentiful, but it remains to be seen how useful they are, and whether the help they provide outweighs the potential problem that different users receive a different presentation of the same page, or even that the same user gets different presentations of a page at different times.
- **Adaptive navigation:** the links and/or the way links are shown is adapted to the user. When the system detects a link on the "current" page, leading to a page that requires prior knowledge the learner does not yet possess, it may alter the link or its presentation so as to warn the user that the link's destination is not (yet) desirable. By suggesting which are "good" links to follow and which are "bad" links, the system offers *guidance* to the learner. Different techniques have been tried to offer such guidance. A commonly used technique is *link annotation*, which means that good and bad links are presented in a different way. The "traffic light metaphor" uses a green link anchor or icon to indicate that a link is recommended, red to indicate that the user is not well-prepared for visiting the link, and yellow to indicate that the link does not lead to new information. Another technique uses *link hiding*. It is similar to annotation, but "bad" links are presented without a visible link anchor. The link may still work, but because it does not look different from normal text the user will not notice it. Yet another technique, mostly used with lists of link anchors, is to sort the links from most to least relevant. Web users know very well that a list is a suggestion to first follow the topmost link and work your way down. More techniques exist, but here also it remains to be seen how useful they are in general. (Research has shown they usefulness in specific cases already.)

The interested reader can find more information on adaptive hypermedia and adaptive web-based systems in the two references below.

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About the Panelists

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Dr. Peter Brusilovsky graduated (with honour) in applied mathematics (1983) from the Moscow State University, where he later obtained a phd in computer science (1987). He is now an assistant professor at the University of Pittsburgh (School of Information Sciences) and an adjunct research scientist at the Human-Computer Interaction Institute of Carnegie Mellon University. His research interest include adaptive web-based systems, intelligent tutoring systems and shells, student and user modelling, human-computer interaction and artificial intelligence. He is author of the (adaptive educational) Interbook system and the influential overview article "Methods and techniques of adaptive hypermedia" (User Modeling and User-Adapted Interaction, vol. 6, nr 2-3, pp. 87-129). He was program chair of the first International Conference on Adaptive Hypermedia and Adaptive Web-based Systems (AH2000, Trento, Italy), and is considered one of the leading experts in the field of adaptive hypermedia.

Dr. Tom Murray has degrees in education (EdD, MEd), computer science (MS), and physics (BS). He has been researching, publishing, consulting, and leading workshops on the subjects of authoring tools, knowledge acquisition, and knowledge representation for advanced technology instructional systems since 1985. He is currently visiting professor of instructional technology at Hampshire College, and director of the Hampshire College Digital Design Center. His research interests include adaptive hyperbooks (the MetaLinks project), Intelligent Tutoring Systems (ITS) authoring tools (the Eon project), and glass box simu lation based learning environments for inquiry learning (the SimForest project). In general his research has focussed on designing systems that allow practicing educators and instructional designers to participate more completely in the design of advanced technology instructional systems. He has also published papers in the areas of ITS ontologies, ITS interoperability and reusability, distributed models of curriculum, exploratory evaluation of software, example-based strategies for teaching concepts, and the representation of instructional strategies.

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Leading Technological Change through Paradigm Shifts

Robert Dean

Leading technological innovation involves significantly more than using the best equipment or software. Human considerations are of major importance. This paper presents a very successful approach to leading faculty and administration through the difficult period of curriculum assessment and the development of the best approach to integrating technology into the curriculum. With over three years of innovative technology implementation, this university presents its chosen implementation strategy and methodologies as a prototype for others to follow.

The presentation outlines successful methods for leading faculty and administration through decision-making and technology implementation in a setting that is both supportive and rewarding. Potential pitfalls are discussed, and approaches are outlined which being about a collaborative university-wide solution to a proper solution despite significant paradigm shifts occurring in higher education.

Extension of RDF(S) with Contextual and Definitional Knowledge

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Abstract: RDF(S) is the emerging standard for knowledge representation on the Web. However, in the context of the European IST project CoMMA dedicated to ontology-guided information retrieval on a "corporate Semantic Web", the RDF(S) expressiveness is too much limited. CoMMA stands for "Corporate Memory Management through Agents". The corporate memory is materialized by the company's Intranet whose documents are semantically annotated in RDF. These RDF descriptions then enable an information retrieval based on the semantics of the documents. However, when compared to object-oriented representation languages, description logic, or conceptual graphs, RDF(S) has a limited expressiveness: in particular it does not enable to declare class or property definitions, nor axioms in an ontology. We propose an extension of RDF(S) to express this kind of definitional knowledge, and more generally contextual knowledge on the Semantic Web. We hope that DRDF(S) will contribute to the ongoing work of the W3C committee for improving RDFS.

Introduction

The need of a Semantic Web is now well recognized and always more emphasized (Berners Lee, 1999). The huge amount of information available on the web has become overwhelming, and knowledge based reasoning now is the key to lead the Web to its full potential. In the last few years, a new generation of knowledge based search engines has arisen, among which the most famous are *SHOE* (Luke *et al.*, 1997) and *Ontobroker* (Fensel *et al.*, 1998). They rely on extensions of HTML to annotate Web documents with semantic metadata, thus enabling semantic content guided search. For interoperability on the Web, the importance of widely accepted standards is emphasized. *Resource Description Framework* (RDF) is the standard proposed by the W3C for the representation and exchange of metadata on the Semantic Web (RDF, 1999). *RDF Schema* (RDFS) is the standard dedicated to the representation of ontological knowledge used in RDF statements (RDFS, 2000).

Our work takes place in the CoMMA European IST project. CoMMA stands for "Corporate Memory Management through Agents". The corporate memory is materialized by the company's Intranet whose documents are semantically annotated in RDF. These RDF descriptions then enable a knowledge-based information retrieval based on the semantics of the documents by using the inference engine *CORÊSE* developed in our team (Corby *et al.*, 2000). However the expressiveness of RDF(S) appears too much limited to represent the ontological knowledge of a corporate memory. Axiomatic knowledge or algebraic properties of relations are crucial for intelligent information retrieval on the Web: they are the key to discover implicit knowledge in Web page annotations (Heflin *et al.*, 1998). Martin (2000) claims the need for additional features and conventions in RDF.

When compared to object-oriented knowledge representation languages, description logics, or conceptual graphs, RDF(S) provides no way for representing axioms, class or property definitions. We propose to extend RDF(S) with these features. We call it DRDF(S) for *Defined Resource Description Framework*. DRDFS more generally, enables to express contextual knowledge on the Web. The RDF philosophy consists in letting anybody free to declare anything about any resource. Therefore the knowledge of who and in which context a certain annotation has been stated is crucial. DRDF(S) enables to assign a context to any set of annotations, in particular for definitional contexts. We first present the RDF(S) model. The RDF(S) extensions with contexts, existential quantification and coreference are then described. The RDF(S) extensions for axioms, class and property definitions are then presented. Finally DRDF(S) is summarized.

RDF(S)

RDF and RDFS

RDF is the Web standard for annotating resources with semantic metadata (RDF, 1999). Everything named by URIs can be considered as a resource and described by annotations. An RDF description consists in a set of statements; each one specifying a value of a property of a resource. A statement is thus a triple (resource, property, value), a value being either a resource or a literal. The RDF data model is close to semantic nets. RDF assertional knowledge is positive, conjunctive and existential. A set of statements is viewed as a directed labeled graph: a vertex is either a resource or a literal; an arc between two vertices is labeled by a binary property. RDF is provided with an XML syntax. Figure 1 presents an example of RDF graph and its XML serialization. It is the annotation of the Web page of T-Nova which is a subdivision of Deutsche Telekom.

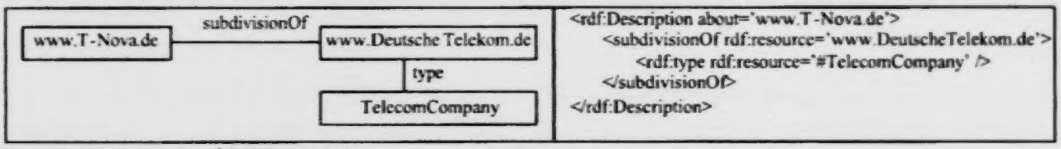

Figure 1: An example of RDF annotation.

RDF Schema (RDFS) is dedicated to the specification of schemas representing the ontological knowledge used in RDF statements (RDFS, 2000). The RDF(S) model thus distinguishes between ontological knowledge (in RDF Schemas) and assertional knowledge (in RDF annotations). A schema consists in declarations of classes and properties. RDFS properties are declared as first class entities like RDFS classes. This feature opposes RDF(S) to object-oriented approaches, where properties are defined inside of classes. Multi-inheritance is allowed for both classes and properties. A property is declared with a signature allowing several *domains* and one single *range*.

The RDFS metamodel is presented in Figure 2.

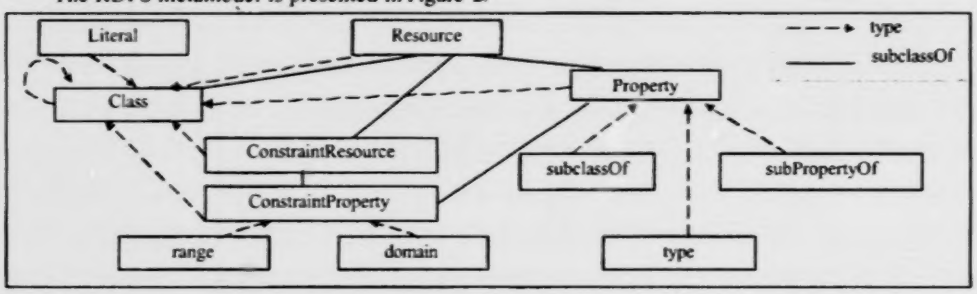

Figure 2: The RDFS metamodel.

To represent domain specific knowledge, a schema is defined by refining the core RDFS. Domain specific classes are declared as instances of the *Class* resource and domain specific properties are declared as instances of the *Property* resource.

RDF Limitations

A Triple Model. The RDF data model is a triple model: an RDF statement is a triple (resource, property, value). When asserted, RDF triples are clustered inside annotations. An annotation can thus be viewed as a graph, subgraph of the great RDF graph representing the whole set of annotations on the Web. However, "there is no distinction between the statements made in a single sentence and the statements made in separate sentences" (RDF, 1999). Let us consider two different annotations relative to two different research projects which the employee 46 of T-Nova participates to:

{(employee-46, worksIn, T-Nova), (employee-46, project, CoMMA), (employee-46, activity, endUser)} and
{(employee-46, worksIn, T-Nova), (employee-46, project, projectXX), (employee-46, activity, developer)}.

The whole RDF graph does not distinguish between these two clusters of statements. Employee 46 is both endUser and developer: the knowledge of which activity he is implicated in inside of a project is lost.

DRDF(S) will enable to represent independent clusters of RDF statements through the *context* feature.

RDF Reification. The RDF model is provided with a reification mechanism. A statement (r, p, v) is reified into a resource s described by the four following properties: the subject property identifies the resource r, the

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predicate property identifies the original property p, the object property identifies the property value v, the type property describes the type of s; all reified statements are instances of rdf:Statement. Figure 3 presents the reification of 'Observer-3002 says that the rating of Newsletter-425 is seminal'.

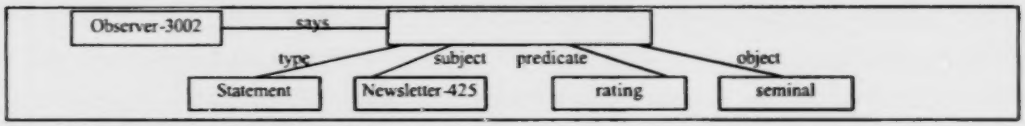

Figure 3: An example of RDF reification.

However, the reification of a set of statements requires the use of a container to refer to the collection of the resources reifying these statements. This leads to quite complicate graphs. Moreover a statement containing an anonymous resource can not always be reified: the values of the properties *subject* and *object* must have an identifier. The notion of context we introduce in DRDF(S) will enable to reify a set of statements much more easily.

Existential quantification. The RDF model focuses on the description of identified resources but allows a limited form of existential quantification through the anonymous resource feature. Let us consider the following RDF statements describing an anonymous resource:

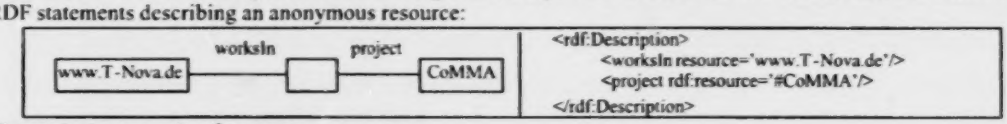

Figure 4: An example of anonymous resource.

This existential quantification is handled by automatically generating an ID for the anonymous resource. However, such a handling of existential knowledge through constants is a limited solution and a graph containing a cycle with more than one anonymous resource can not be represented in RDF. DRDFS will enable to represent every existential, positive and conjunctive statement, without any restriction.

The roots of DRDF(S) stand in the correspondence between RDF(S) and the conceptual graph (CG) model (Sowa, 1999). The CG model provides a direct way of expressing independent pieces of knowledge through graphs. It thus enables the representation of contexts for various applications (quotations, viewpoint, ...). CGs are particularly useful as definitional contexts enabling the definition of concepts or axioms (Delteil *et al.*, 2001). An in-depth comparison of both models is studied in (Corby *et al.*, 2000).

Extending RDFS with contexts

DRDF(S) is provided with a notion of context to express the clustering of statements much more easily than RDF reification. A context identifies a sub-graph of the whole RDF graph. Let us consider again the two projects of T-Nova which Employee-46 participates in. The statements relative to one project can now be clustered in a context and then separated from the statements relative to the other projects.

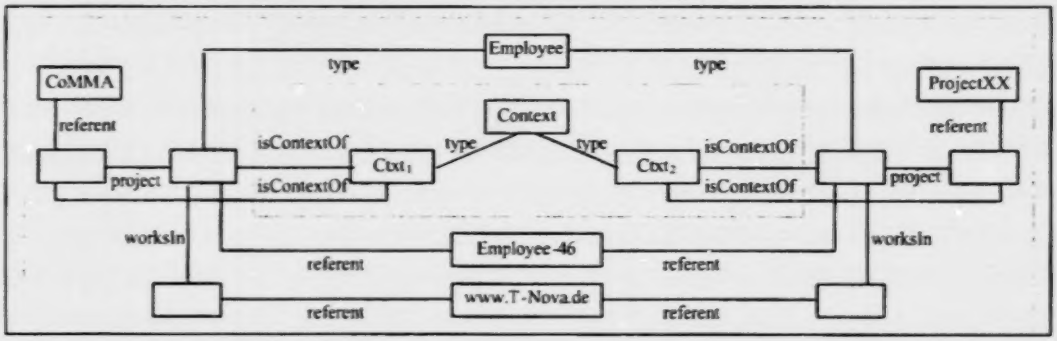

Figure 5: Two contexts about the same resource Employee-46.

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The rules for extracting the set S of triples belonging to a context from the RDF graph are the following:

- Select a resource G of type Context; $S \leftarrow \{(G, type, Context)\}$.
- Select all the anonymous resources $c\varnothing_i$ for which the value of the *isContextOf* property is G; for each i, $S \leftarrow S \cup \{(G, isContextOf, c\varnothing_i)\}$.
- Select all the identified resources r_j values of a *referent* property of a $c\varnothing_i$; $S \leftarrow S \cup \{(c\varnothing_i, referent, r_j)\}$.
- Select all the properties p_{ik} between two resources $c\varnothing_i$ and $c\varnothing_k$; $S \leftarrow S \cup \{(c\varnothing_i, p_{ik}, c\varnothing_k)\}$.

A context is defined from a resource G of type Context as the largest subgraph of the whole RDF graph whose all internal nodes excepted G are anonymous resources $c\varnothing_i$. A context is an abstraction that enables to talk about representations of resources (through anonymous resources) rather than directly about resources. For instance, in Figure 5, the resource Empoyee-46 is referred to by two distinct anonymous resources in two different contexts. Anonymous resources are "externally identified" by the *referent* property.

This general notion of context will appear of particular interest for expressing definitional contexts.

Extending RDFS with existential quantification and coreference

DRDF(S) is provided with a general mechanism for existential quantification handling. An existential quantification is represented by an anonymous resource described by a *referent* property whose value is an instance of *Variable*, a new RDF class we introduce. Figure 6 presents an RDF graph that could not be represented in the standard RDF. The cycle is resolved by two *referent* properties sharing the same value.

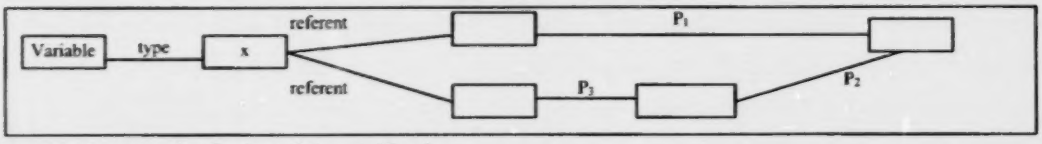

Figure 6: An example of existential quantification.

The scope of a variable is the context it belongs to, just like in FOL, where the scope of a variable is the formula it belongs to. We introduce a *parameter* property to link two resources of types *Variable* and *Context*.

Extending RDFS with class and property definitions

Extending RDFS with class definition

DRDF(S) class definition is descended from type definition in the CG model. A class definition is a monadic abstraction, i.e. a context whose one resource of type Variable is considered as formal parameter. To extend RDFS with class definitions, we introduce the following new RDF primitives:

'DefinedClass': A defined class is of type *DefinedClass*. *DefinedClass* is a subclass of *rdfs:Class*.

'hasDefinition': A defined class is linked by a *hasDefinition* property to its definitional context.

'FormalParameter': The variable linked to the definitional context by a *FormalParameter* property corresponds to the formal parameter of a monadic lambda abstraction.

Figure 7 describes the definition of the 'WebPage' class as a document represented in HTML.

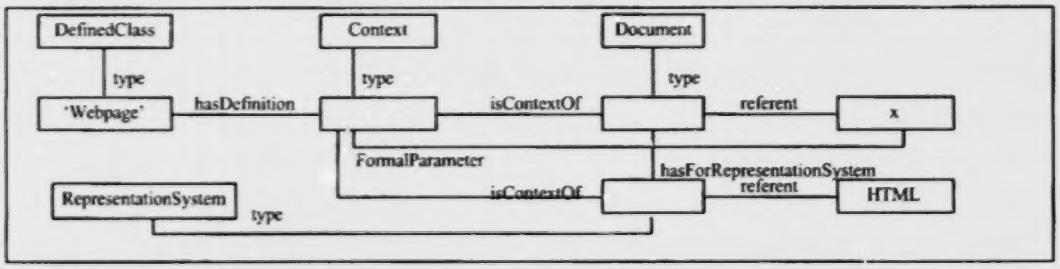

Figure 7: Definition of the 'WebPage' class.

Extending RDFS with property definition

DRDF(S) property definition is descended from type definition in the CG model. A property definition is a diadic abstraction, i.e. a context whose two resources of type Variable are considered as formal parameters. To extend RDFS with property definitions, we introduce the following new RDF primitives:
'DefinedProperty': A defined property is of type *DefinedProperty*. *DefinedProperty* is a subclass of *rdf:Property*.
'FirstFormalParameter' and 'SecondFormalParameter': The variables linked to the definitional context by these properties correspond to the formal parameters of a diadic lambda abstraction.

Extending RDFS with axioms

DRDF(S) axiom definition is descended from axiom definition in the CG model. An axiom is a couple of lambda abstractions, i.e. two contexts representing the hypothesis and the conclusion. To extend RDFS with axiom definitions, we introduce the following new RDF primitives:
'Axiom': An axiom is a resource of type *Axiom*. *Axiom* is a subclass of *Context*.
'if': An axiom is linked by an *if* property to the context defining its hypothesis.
'then': An axiom is linked by a *then* property to the context defining its conclusion.
The variables linked by a *FormalParameter* property to the resource of type *Axiom* correspond to the common formal parameters of the two lamb da abstractions.
Figure 8 describes the definition of the axiom "If x is colleague of y, then y is colleague of x".

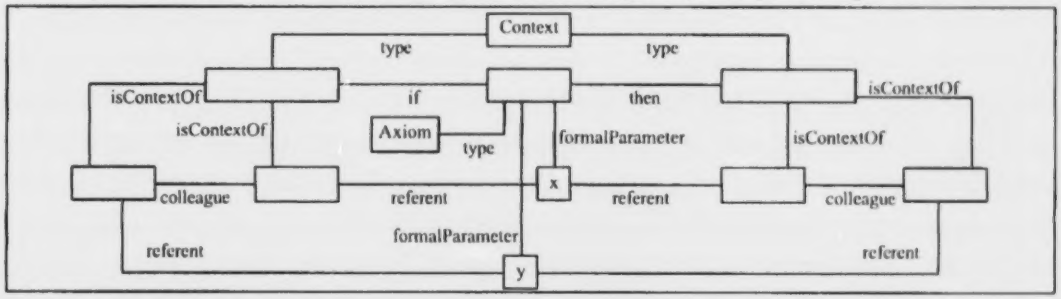

Figure 8: Definition of an axiom.

The Defined Resource Description Framework Schema (DRDFS)

We call Defined Resource Description Framework Schema (DRDFS) the set of RDFS primitives augmented with the ones we introduced in the previous sections. DRDFS is an RDF Schema and remains compliant with the triple model. The metamodel of DRDFS is presented in Figure 10.

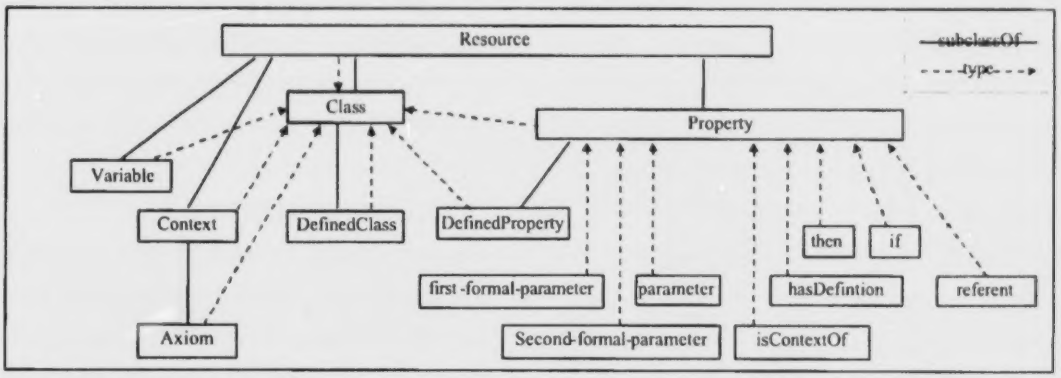

Figure 9: The DRDFS metamodel.

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Conclusion

DRDF(S) is an extension of RDF(S) dedicated to ontology representation on the Semantic Web. It enables the representation of axioms, class and property definitions in ontologies. More generally, it provides a way to represent contextual knowledge on the Web. We hope that DRDF(S) will contribute to the ongoing work of the W3C committee for improving RDFS.

Since DRDF(S) is an RDF Schema, it is compliant with existing RDF parser. However, the semantics of the new introduced primitives can not be understood by them. A DRDF(S) interpreter is currently under implementation. It is based on the existing platform *CORESE*. In the framework of the CoMMA project, DRDF(S) will enable the representation of rich domain ontologies for intelligent information retrieval in the Intranet of companies.

Several languages for ontology representation and exchange are existing, among which *SHOE*, RDF(S) and *OIL* are dedicated to the Web (Corcho *et al.*, 2000). RDF(S) is the emerging standard proposed by the W3C. Like DRDF(S), OIL (Fensel *et al.*, 2000) is defined by an RDF Schema. Compared to OIL, DRDFS provides the Semantic Web with the notion of *context*: by enabling the representation of contextual knowledge, it is of special interest to identify the origin of an annotation on the Web; it also enables the representation of existential knowledge. Finally, it enables the representation of defining graphs for classes, properties and axioms through definitional contexts.

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Personal Information Organization using Web Annotations

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Abstract: As more information is made available online, users collect information in personal information spaces like bookmarks and emails. While most users feel that organizing these collections is crucial to improve access, studies have shown that this activity is time consuming and highly cognitive. Automatic classification has been used but by relying on the full text of the documents, they do not generate personalized classifications. Our approach is to give users the ability to annotate their documents as they first access them. This annotation tool is unobtrusive and welcome by most users who generally miss this facility when dealing with digital documents. Our experiments show that these annotations can be used to generate personalized classifications of annotated Web pages.

Introduction

Organizing Web pages collected in our bookmarks is a long and highly cognitive task. Most users would be happy to delegate this activity to an automatic classifier (Abrams 1998). User studies also show that the number of bookmarks grow linearly with time and that most users do not organize their bookmarks at creation time. Because they do not classify at creation time, they have to organize a large number of bookmarks and typically do not remember what was interesting in a particular page. Remembering what was interesting can also be impossible when the Web page has been modified or is not longer available, which is typical on the Web. One solution used in Vistabar is to index every Web page loaded in the browser (Marais & Bharat 1997, Li 1998). The other approach is to store a signature of each page which can help to retrieve the page from the Web when its URL has changed (Phelps & Wilensky 2000). But indexing or being able to retrieve the same page on a different location does not necessarily help the user to remember why this page has been saved as a bookmark. We believe that being able to annotate the document would certainly help users remember their activities around this document and thus help them classify it.

Even if marks can help users remember what was important in a document, there is still a need to help them automatically classify these documents. Automatic classification has been applied to cluster bookmarks (Maarek & Shaul 1996). The results do not show if these automatic classifications fit user expectations. We argue that since a Web page can contain several topics like home pages, listings and online news papers, using all the words to classify this Web page will probably lead to bad classifications because only a subset of this page might be of interest to the user.

In this paper, we use a Web annotation system to let users highlight and possibly annotate the Web pages they access. Annotating on paper is ubiquitous and some annotation systems like ThirdVoice, iMarkup and eQuill are now available to mark Web pages. In our experiences, we have used Yawas, a Web annotation system prototype that supports the creation of annotations in a fast and effective way using Dynamic HTML and the Document Object Model (Denoue & Vignollet 2000).

By annotating Web pages, users select words which can then be used to represent each document. This paper is organized as follows. In the first part, we present a pilot study which tries to understand the utility of annotations to help someone understand the topic of a document. In the second part, we present the results of applying an automatic classification algorithm to classify the documents, first using the traditional approach which indexes the full text of the documents, and secondly using only the annotated passages in each document to represent the documents. We show that representing the documents by their annotations provides more personalized classifications than when the documents are indexed with their full text.

Pilot Study: Manual Classification of Web Pages

Experimental Method

To gain an insight into the usefulness of annotations to classify Web pages, we asked two subjects to manually classify 333 annotated documents. Subjects were also asked to name the groups of documents. No time limit was imposed. The first subject is the author of the annotations, while the other subject was not familiar with the documents. Each subject had to complete two classifications. In the first setting, the original document was downloaded into a Web browser so the subject could see the complete page and manually classify it. In the second experiment, each document was represented by the list of annotated passages in this Web page.

Results

When accessing the original documents, the subjects took approximately 3 hours to classify the documents, and 2 hours and 30 minutes to classify them when using the annotations. This difference is primarily due to the time required to retrieve the documents from the Web and browse them. Subjects could not classify 10% of the documents because their URLs were broken. On the other hand, all documents have been classified when using the annotations.

For a given subject, the number of classes is not significantly different. However, the author of the annotations created 60 classes, while the other subject created 40 classes. This is not surprising since the author of the annotations is more apt at differentiating topic amongst the documents. For both subjects, the names created when considering the highlighted texts were more precise. For example, "conference" was used instead of the more appropriate "classification", and "home page" was used instead of "annotation". Using the annotations, subjects have then been able to generate more precise group names.

To test how annotations can help an automatic classifier to build a classification that better fits a particular user, we used the classification provided by the author of the annotations as a reference and compared it to the classifications produced by the second subject. The second subject misclassified 35 documents when using the full text of the documents, but only 5 when using the annotations to represent each document. This result suggests that an automatic classifier could also take advantage of the annotations to generate a personalized classification.

Moreover, we observed that most documents contained about 10 annotated words (after the indexing step). This further suggests that the annotations could be used to generate concise representations for documents, similar to the representations used by current search engines on the Web.

Second Study: Automatic Classification

Since the manual classification of the documents showed encouraging results, we conducted a second experiment using an automatic classification algorithm.

Classification Algorithm

Numerous algorithms are available to classify data and most of them can be applied to document classification. Each document is represented by a vector of features. Features are typically words, but other data could be used like the date of creation, the author, etc. Since most users tend to classify their documents by topics, we represented the documents by their words. Basically, two approaches can be used to classify a set of documents: supervised classification using machine learning techniques and unsupervised classification (also known as clustering).

Supervised classification requires a set of pre-classified documents where each document is associated to a predefined class. A machine learning algorithm like decision trees or Naïve Bayes is used to find a function which maps documents to their class (Mitchell 1997). This function is then used to predict the class of a new document. Classifying bookmarks with this approach would require users to pre-classify a subset of the bookmarks. Some authors have avoided this step by using the Yahoo! classification scheme where thousands of Web pages are already classified (Chen & Dumais 2000, Li 1998, Marais & Bharat 1997). In this experiment, we didn't use this approach since we wanted to discover a personalized classification. Yahoo! would have given us a more general classification which we believe is not necessarily adapted to every user.

On the other hand, unsupervised classification does not require a set of pre-classified documents. Documents are compared to each other and the algorithm tries to structure them. This structure depends on the nature of the algorithm. Some of them - like the single pass algorithm - produce a flat classification of the documents. Others like the hierarchical agglomerative clustering (HAC) induce a hierarchy of classes. Although flat classifications can further be split to create a hierarchy, we chose to use the HAC algorithm because it does not require a priori knowledge about the number of classes and does not require a threshold when comparing two documents (see (Rasmussen 1992) for details).

In the first step of the HAC algorithm, each document is put in one class. At each subsequent step, the two most similar classes are merged. The algorithm typically ends when there is just one class. There are 3 basic alternatives to compute the similarity between two classes, also known as "single link", "complete link" and "group average" described in (Rasmussen 1992). We implemented all of them in our experiment. Documents were indexed by removing common words from a stop list and by further applying the simple Porter stemming algorithm (Porter 1980).

Experimental Method

We used the 400 annotated documents used for the pilot study. We have implemented the 3 most common variants of the HAC algorithm "single link", "complete link" and "group average". We ran the classifier for each variant, first using the full text to represent the documents, and then using only the annotated words in each document. To compute the quality of the classifications, we compared each of them to the reference classification obtained from the author of the annotations using the quality measure used by Zamir and al. (Cutting et al. 1992):

$$Quality(C) = \sum_{g \in C} \sqrt{t(g)} - \sqrt{f(g)}$$

where t(g) is the number of pairs of documents in one cluster which have also been classified together in the reference classification, and f(g) is the number of pairs of documents in one cluster which have not been classified together in the reference classification.

The global quality sums the difference between t(g) and f(g) for every cluster in the current classification. In our experiment, each document has been indexed by removing common words from a stop list and by further applying a simple stemming algorithm (Porter 1980).

Results and Discussion

(Figure 1) shows that the quality is always better when using the annotations. The graphic show the quality of the classification at different merging steps as the HAC algorithm is running. At the first step, the quality is null since no documents are merged: the number of correctly classified documents is equal to the number of misclassified documents. Using the full text of the documents, the quality never goes far above zero, meaning that the classification is never useful for the user: the same number of documents is correctly of incorrectly classified.

On the other hand, the quality reaches a maximum above zero when the annotations are used, suggesting that at some point the classification becomes useful (more documents are correctly classified). Determining this point can be useful but this is not crucial since the HAC algorithm never modifies its previous merges as it runs, thus preserving the quality of the classification obtained at the previous steps. However, the classes become populated with noisy documents and it might be desirable to stop the HAC algorithm before. On our sample of 450 annotated documents, we found that this maximum was reached when there was only one word left to represent a class. In our implementation, each class is represented by the intersection of the words included in the documents of this class.

One typical problem with HAC algorithms is that they tend to produce a deep hierarchy, which is not desirable if users need to browse it. A maximum of 5 levels is usually recommended (Larson & Czerwinski 1998). One solution is to arbitrarily slice the hierarchy into 5 or more levels (Maarek & Shaul 1996), but it is not clear how this threshold fits all tasks and how valuable distinctions among documents is lost with this simplification. In our sample of annotated documents, the deepest level is about 4 in the classification when the curve reaches a maximum.

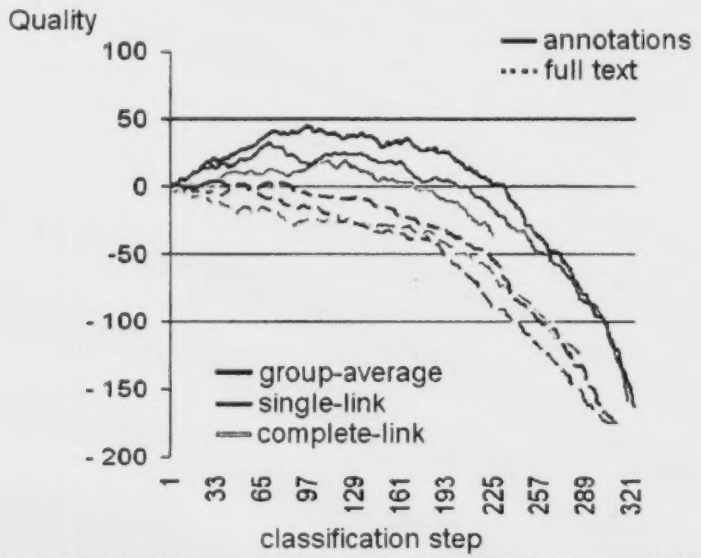

Figure 1: Quality of the classification at different steps of the HAC algorithm; Dashed lines represent results when the full text is used and solid lines represent results when the annotations are used; 3 variants of the HAC algorithm are shown in different gray scale for the full text and for the annotation.

Using the intersection of words contained in one class to name this class, we found that annotation-based classification generate better and more concise names, typically varying from 10 to only 1 word. This is consistent with our preliminary findings and in sharp contrast with the names obtained when the full text is used. In this later case, class names are useless and further filtering based on TFIDF would be required. To browse the hierarchy, users also need to see document representations. Since our pilot study suggested that annotation-based document representations were useful to understand the meaning of a document, we chose to use this representation in the classification as well.

Concluding Remarks

We believe that being able to annotate digital documents like Web pages can dramatically improve the user experience of accessing information online. Annotating is very natural on paper and few tools are currently supporting this activity for digital documents (see Xlibris in Schilit et al. 1999). But digital annotations have the potential to push the limits of their paper-based counterpart. Our experiments suggest that they can

support users in other activities like the classification of personal information. Using the same approach, annotations can also be used to improve information retrieval (Golovshinsky et al. 1999). Annotation tools will play an increasing role in personal information management systems by helping users to filter and organize vast amounts of information they collect in their personal spaces. Email and Web pages are current examples. More importantly, by annotating their documents, users build personal profiles which could be used to retrieve documents out of the personal space.

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Teaching Web Development at Undergraduate and Postgraduate Levels Experience and Recommendations

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Abstract: Universities teach computing mainly in terms of computer science, software engineering and information systems, and, also, as computer engineering and networking, both at undergraduate and graduate levels. Teaching Web Development does not fit neatly into any of these categories. This paper outlines our experience in teaching Web development at the undergraduate level and then argues that this area, which we have called Web Engineering, is best taught at the master's level, for several reasons. The justification rests on factors such as the multidisciplinary nature of Web development, the strong influence of non-IT disciplines on it, the maturity levels of the developers themselves, and their awareness and understanding of legal and socio-economic factors affecting Web-based applications. The paper presents a brief outline of the master's course in Web Engineering that we have offered since 1999, reviews our experience and makes recommendations for curricula.

1. Introduction

Universities organise undergraduate and graduate courses in computing and Information Technology (IT) focussed on traditional disciplines such as Computer Science (CS), Software Engineering (SE), Information Systems (IS), Computer Engineering and Networking. Web site and applications development do not fit well within these boundaries and yet, given its multidisciplinary nature, impact and complexity, it is essential that Web development be treated in a serious, academic manner. Web development requires not just the technical skills but, more essentially, ability to understand and deal with its global impact and the additional responsibilities that must be discharged by the developers in social, ethical and legal terms.

We (at the School of Computing & IT, University of Western Sydney, Australia) have been teaching Web development to the undergraduate students since 1997 and the graduate students since 1999. Over the years, other institutions, academic and commercial, IT and non-IT, have developed various courses to teach parts of Web development. However, their focus very often is on imparting specific skills required for the current technologies and packages. They do not prepare students to face a whole gamut of issues, life-long learning or to discharge their social, legal, ethical and professional responsibilities. These areas require a level of maturity, ability and willingness to think through and beyond the boundaries of traditional disciplines.

Our experience and analysis of the Web environment and developmental activities have led us to the conclusion that Web development, which we have called Web Engineering (for reasons explained below and elsewhere), is best taught in all its complexity at the graduate level. This paper offers rationale for this conclusion and, in the process, outlines a curriculum that we have used at the master's level since 1999.

The paper is organised as follows. Section 2 describes the motivation for teaching Web development. Section 3 deals with traditional disciplines and why formulation of Web Engineering as a discipline makes sense. Section 4 describes our experience in teaching Web development at the undergraduate level. Section 5 explains the rationale behind the master's course, its nomenclature, aims and objectives, and structure. Section 6 reviews our experience in running the master's course. Section 7 concludes with recommendations.

2. Motivation for Teaching Web Development

It is a truism that what we teach our students has to be relevant to the world in which they will live and work. They also have to understand the world they have inherited, and learn to anticipate how it is changing, even as they shape parts of it for themselves. Our world is going through a very rapid change in the way people live, work and organise themselves. New technologies are being introduced in all spheres of life at such a rate that 'information explosion', 'information overload' and 'information management' have become terms of common usage and are seen as problems for all professions and professionals. Curriculum development and updating existing curricula, therefore, assume a high importance and are of concern not only to the students, parents and educationists but also to governments, business and industry, and professional bodies.

The World Wide Web, and all its associated developments, is a phenomenon that has confounded everyone. All disciplines and professions, and the general public, are trying to understand and explain it in their own ways. It seems only logical that universities take up the challenge of understanding its development and all the implications, both in terms of teaching and research. We started two undergraduate course units in 1997 to teach students Web site construction and Web-applications. These were and remain technically oriented.

However, there are now millions of Web sites and thousands of Web-based applications useful to a greater variety of people than ever before. In many cases, the development approach used for Web-based systems has been ad hoc, lacking in rigour and a systematic approach. As Web-based systems grow more complex, a failure in one system can and will propagate broad-based problems across many. Furthermore, the global reach of the Web imposes upon Web developers a much greater responsibility in social and professional terms. The Web developers cannot live in cocoons that have generally enveloped the IT professionals. It is not enough to have only or mainly technical virtuosity where Web development is concerned.

We became aware of the complex and multidimensional nature, both in IT and non-IT terms, of the Web through the work we started at what was the University of Western Sydney Macarthur in 1996 (Murugesan et al 1999,). We reached a conclusion that a new discipline had to be formed to encompass the true nature of Web development and called it Web Engineering (see below). The graduate course arose out of this experience.

3. Traditional Boundaries in Computing and IT and a Paradigm Shift

In the Information Technology (IT) arena, universities and training colleges typically develop their own niches to attract students from different demographics. Academics draw boundaries around disciplines such as CS, SE and IS and debate the validity of these boundaries and their natural habitat. There are also other, more hardware oriented disciplines such as Computer Engineering and Networking. Professional organisations such as the Association for Computing Machinery (ACM), the Institute for Electrical and Electronics Engineers Computer Society (IEEE-CS), the Association for Information Systems (AIS) and others reinforce the distinctions among these disciplines even as they have started to emphasise commonalities between them. Their recommendations for curricula over the years are evidence of all the forces at play in deciding the undergraduate and graduate curricula across the globe. For an excellent overview of these developments, see (CC2001, 2001).

The arrival of the World Wide Web and the explosion of activities around and based on it caused a stir and controversy (Pressman, 1998). For many computing professionals, the Web was only about presentation, justifiably. HTML was not even a programming language. The Web, therefore, was not to be taken too seriously. To the computer science purists, the Web was "just an application of distributed systems". To the software engineers, developing Web-based applications presented no shift in paradigm and software engineering methods and techniques were just as applicable and useful in the new environment. The Web and Web development were treated with benign neglect by these groups.

It was in this context that Web Engineering was first proposed as a new discipline (Murugesan et al, 1998, 1999, Deshpande et al, 1999, and 2001). By Web Engineering, we mean: use of sound scientific, engineering and management principles and disciplined and systematic approaches to the successful development, deployment and maintenance of high quality systems and applications. The basic tenet of the argument is that developing Web-based applications requires not only understanding of and skills from CS, SE and IS but also information architecture, navigational design, hypertext, graphic design, multimedia, document management, legal, social and ethical issues and diffusion of innovations. Developing Web sites and Web-based applications, thus, was different from and went beyond CS, SE and IS (Deshpande et al, 1999, 2001). We named this as Web Engineering,

The validity and relevance of the new discipline has been tested now over four years through one-day workshops at the World Wide Web conferences (1998-2001), two two-day workshops at the International

Conference on Software Engineering (1999-2000) (see online proceedings listed in among the references) and special tracks on Web Engineering at the Hawaii International Conference on System Sciences (2001 and 2002 to come). See also, Murugesan and Deshpande, 2001.

The paradigm shift brought about by the Web has to be adequately reflected in the academic courses. The next section describes our early efforts at the undergraduate level.

4. Teaching Web Development at the Undergraduate Level

The introduction of course units in Web development at the undergraduate development has been mentioned before. These are in the form of two subjects at second and third year undergraduate levels. The two subjects together take students from basic Web development to interactive site building, client and server-side scripting and building prototype e-commerce and other applications. The students are expected to be fully conversant with programming, database design and SQL. Both subjects are very popular.

Again, based on our experience in developing and running real-life Web applications, as also on analysis and constant feedback from IT and non-IT colleagues, we tried to incorporate the non-IT aspects of Web development that are absolutely vital for the success of any Web site and application. These deal with, in a very limited way, graphic design, usability, document management, legal, social and ethical responsibilities and others briefly mentioned before.

Not surprisingly, the undergraduate students thought of Web development mainly in technical, computing or programming terms. For them, the new technology itself was fascinating and the rest either irrelevant or a waste of time. Questions of copyright, privacy laws, accessibility, document management, maintenance or how to deal with information explosion were not seen as part of the overall Web development. We realised that there had to be a shift of focus to more mature, experienced students in order to rise above the merely technical, and also with an appeal to non-IT graduates that they could and had to contribute to Web development.

We also found that a majority of CS, SE and IS academics were not inclined to think in terms of incorporating Web development in their own areas. In any case, their appeal would have been to only IT students. The master's course in Web Engineering and Design was formulated out of this experience and based also on wide discussions with other IT and non-IT colleagues and professionals.

5. Master of Information Technology (MIT) in Web Engineering and Design

5.1 Rationale

Previous sections have outlined part of the rationale behind the master's coursse. In specific terms, back in 1998, the educational programmes did not cater to the wide-ranging issues raised by the nature of Web and related developmental activities, even at the Master's level. Many institutions had typically taken much more restricted programming-oriented or graphic design-oriented approaches when dealing with the Web or almost completely ignored the Web's influence and potential when dealing with IT/IS curricula, except in flexible delivery.

However, a thorough and systematic exploration of the topics/subjects and issues connected with Web-based systems, and mentioned above, is best carried out at a level which rises above the undergraduate level. The undergraduate courses typically concentrate on the technical competency and it is mainly at the master's level that students start to ask the difficult questions about what works in specific situations, what does not, why and what can be done about it. It is at that level, with a certain degree of maturity that they start to devise and systematically experiment with their own solutions.

5.2 Nomenclature

Given the line of argument above, the name for the course had to be specific to convey the IT orientation but general enough to suggest to non-experts that there was possibly some difference between this course and those dealing with CS, SE and IS. IT is sufficiently generic to suit the purpose.

Similarly, although engineers contend, with reason, that engineering includes design, the general perception among non-engineers is that the design aspect is often overwhelmed by the standard engineering practices. "Web Engineering and Design" as the name for the specialisation overcomes this perception.

5.3 Aims and Objectives

The MIT in Web Engineering and Design course aims to produce graduates who are able to understand and deploy the rapidly developing and evolving Web Technology through sound scientific, engineering and management principles and disciplined and systematic approaches to the successful development, deployment and maintenance of high quality systems and applications. In the process, the students will learn to correlate these developments and practices to the needs of the global, social and political economy.

Specifically, this course aims to:

1. provide graduates with a critical appreciation of IT/IS methodologies, the Web technologies, innovation, and their roles within an organisation;
2. enable graduates to build Web-based applications using multimedia and hypermedia based upon sound methodologies in project management and people management;
3. impress upon graduates the links between their professional work and social, legal, ethical and professional issues through case studies and on-going analysis of current developments;
4. enable graduates to acquire skills and expertise in quantitative and other methods of performance analysis, capacity planning;
5. cover new developments in intranets, extranets and Internet;
6. build up graduates' expertise in quality and security management;
7. provide a global business and IT perspective to the graduates;

5.4 Course Structure

The course comprises 8-units (subjects) delivered over two semesters. It consists of four core subjects, a 2-semester IT project and two electives.

The main eligibility criteria for admission are a 3-year degree course, preferably in Computer Science or Business Computing or equivalent. However, In keeping with the philosophy behind the programme, and especially that of Web Engineering and Design, students showing considerable potential for successful completion without full, prior qualifications in computing are also eligible provided they complete a one-year graduate diploma in IT. Figure 1 presents the course structure. A short description of the subjects follows.

Semester 1			
Web Technology	IT for Virtual Organisations	Project Management	Elective
Semester 2			
Web Site management and Security	Web-based Application Development	Project	Elective

Figure 1: MIT in Web Engineering and Design – Course Structure

Web Technology is the foundation of Web Engineering and Design. The subject focuses on Web page design and authoring tools, HTML, individual site development and management, database connectivity and ODBC, authoring and legal issues, and browser side scripting. It also includes the design, development and implementations of server-side applications, the use of multi-media, the principles of intranets and extranets, security, and access rights.

IT for Virtual Organisations challenges students to think outside the current practices and boundaries and prepare for the now already almost-cliched 'virtual' organisations, technologically and inother ways.

Web-based Application Development covers new technologies associated with the Web, such as XML, ASP, JSP and others and analyses the technological, organisational and other important factors behind their successful adoption. It examines the current methodologies and their appropriateness for the Web, the trends in

End-User Computing and user interfaces and how organisations may cope with complex demands of information management including the issues of security, privacy and copyright.

Web Site Management and Security introduces students to the management aspects of the running and the implementation of Web services in an organisation. It includes the development of a working knowledge of current legal, copyright, privacy and intellectual property rights issues with the corresponding obligations and responsibilities; the implementation of network/server and data communication security along with the respective policy generation and management; the integration with an organisation's information systems; a working knowledge of standards and certification bodies; a working knowledge of current e-commerce financial and ethical issues; and an operational view of web development and development team requirements.

IT Project is a 2-semester long project wherein students pursue specific topics and their own interests related to Web development and in the process not only develop an application but also learn project management, communication skills and aspects of innovation

6. Review of the Course

The course has now run for more than two and a half years with two intakes per year. The experience of starting a new course, with its different emphasis from other courses, and seeing it grow has been gratifying, baffling and sobering, all at the same time. Here, we briefly report on five main areas of experience.

6.1 Growth

The first intake for the new course was about 15, in the first (southern hemisphere) Spring semester of 1999, starting in March. Since then the demand and the quality of applicants have both gone up. In the Autumn 2001 semester intake, 60 new students enrolled in the course. Now that the dot com crash has created headlines, it is a moot point if this growth will continue in the short term. It is also uncertain if this popularity is because of the specific nature of the course or due to the high demand for IT courses overall. This ambiguity is further heightened by the following observations.

6.2 Predominance of non-IT Students

Most of the students for Web Engineering and Design have come from non-IT background. Students with computer science or information systems tend to gravitate to the familiar and standard offerings. Again, it is debatable whether this is symptomatic of narrow specialisms engendered by IT with its emphasis on technical and technological know how or the lack of perceived need for Web Engineering and Design, since there are no comparable courses to our knowledge.

6.3 Levels of Maturity

In proposing the course, we had argued that the study of Web Engineering required certain maturity and technical nous. The course had to be at the graduate level and would appeal to the non-IT graduates as well, especially since it acknowledged and tried to build upon the contributions from other disciplines. There were indeed some outstanding successes among the non-IT students, especially among those who understood what the course aimed at and worked on those aspects. A large proportion, however, seemed to be satisfied by, and wanted, only well-defined, technical details and problems.

6.4 Narrowly Focussed Training vs Liberal Education

A large percentage of students wanted, and argued for, training in specific technologies, Oracle 8i or ColdFusion or DreamWeaver or multimedia or Java and so on. This narrow, technological fixation, if it is a wider phenomenon, will need to be tackled on a much wider front.

6.5 Motivation

In any endeavour, motivation is a big factor behind success. The students' motivation levels, as always, varied significantly. As implied in the observations above, there were many who were simply driven by the 'market forces'. However, there were others who have gone on to lead Web development at a higher level, more quickly. Their feedback to us about Web Engineering has been gratifying.

7. Recommendations and Conclusions

This paper has reported on our experience in teaching Web development at the University of Western Sydney. This has been an innovative and in many ways pioneering experience. Other universities also teach Web development but generally in terms of programming, client-server computing, Web design, e-commerce and internetworking. Some have also started, or plan to start, teaching Web Engineering. Although the Web is world wide, the experiences, expectations and performance of people involved in teaching and learning Web development are bound to be have significant variations.

We started the master's course in Web Engineering and Design by learning from experience and by reasoning out that Web development can be taught at the undergraduate level only on a limited scale and that it is best pitched at more mature and experienced developers at graduate level. Our experience over the last two and a half years seems to bear that out, but is inconclusive, especially in the context of a volatile environment.

Web Engineering is a forward looking, evolving discipline and like the discipline itself, its practitioners have to be broad-based and future oriented. The Web engineers need broader perspective and maturity of outlook to avoid the pitfalls of narrow specialisations, hype, and confusion of new technologies. They have to acknowledge that Web development is multidisciplinary and respect the contributions other disciplines and people can make to any Web project. They need the humility to admit their own limitations and develop abilities to work in a really multidisciplinary team where the work or the project takes precedence and individual egos and preconceptions have to be subsumed. These are the challenges that good curricula have to address to do justice to the potential of the Web.

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Maintaining Semantic Constraints in Web Sites

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Abstract: Many tools already exist to help in creating Web sites, but there are more concerned by the external appearance of the sites than by their content. How can we help in designing and maintaining semantically coherent sites ? Using software engineering technics, and more exactly *Natural Semantics*, a framework coming from the world of the semantics of programming languages, we propose a way of specifying and verifying the semantics of a Web site during its life time.

Introduction

As Web sites tend to become ordinary products, it is necessary to better explicit the notion of quality of a Web site. Most of the time, Web sites are updated very frequently by many authors and in this context, proof-reading is a real challenge. The quality of a site may be linked to the easiness of accessibility and also to other criteria such as the fact that the site is coherent or up to date.

Many efforts aim to facilitate data representation and data mining. This is done most of the time by a syntactic formalisation of knowledge or information using languages such as XML or RDF. We claim that this is not sufficient and that we need to provide a way of specifying semantic (i.e. global) constraints over Web sites to be able to mechanically perform some verifications and proof-reading during the life time of the site.

After presenting some examples of semantic constraints in Web sites, we present the main ideas of *Natural Semantics*, a framework used to specify the semantics of programming languages, and some experiments done with it to specify and verify different Web sites.

The Meaningful Content of a Web Site

Nowadays, tools dealing with Web sites (that we define simply as a set of pages) are mainly concerned by the appearance of the pages, their physical location on a file system and some structural problems such as dangling links. Two ideas are now broadly accepted to better take into account the content of Web sites:

- The first idea is to separate the content of a site from its presentation. This leads mainly to XML, XSL and related formalisms such as XML Schema (W3C, 2001). The objective here is to choose a syntax that suits not only the structure, but also the semantics of the information that is presented by means of syntactic tags and DTDs. This technique corresponds to the notion of abstract syntax in the world of programming languages.
- The second idea is to annotate the content of the pages, most of the time devoted to human consumption, by a more computer-oriented form. This may be done by using meta-tags or RDF annotations (W3C, 2001), or can be disseminated in the text (van Harmelen and van der Meer, 1999; van Harmelen and Fensel, 1999). Using shared ontologies is, at this stage, a reasonable option (Fensel et al., 1998; Berners-Lee, 1998).

However, this is not because a document is well-formed (i e. respecting a particular DTD) or correctly annotated that it is semantically correct. It is of course impossible to guarantee that the content of a page or of a site reflects the exact idea of its creators. But it should be possible to check, using a large set of tools involving text analysis, picture analysis, thesaurus, etc. that the content of the site is coherent, that the annotations are coherent, that the annotations and the contents are coherent. These constraints are no more syntactic but semantic. By describing such constraints, we want not only to be able to specify constraints, but also to generate the appropriate tools to mechanically verify that these constraints are fulfilled and to provide error messages or warning when it is necessary.

Semantic Constraints in Web Sites

In everyday language, there is an unprecise barrier between meaning, knowledge and semantics. In software engineering, semantics of programming languages may be strongly defined, with a distinction between the static semantics (the rules that a program must respect to be legal) and the dynamic semantics (formalising what happens when a program is executed). For a Web site, we can also try to define static semantics (rules that must be checked before publishing), and dynamic semantics (formalising what happens when a user navigate inside a site).

Static semantics really exist for natural languages: in the literature, we can imagine that the names of the characters appearing in a play must be defined in a global list of characters in the same way that the objects used in a program must be declared. The same feature exists in institutional Web sites in which we can think of the organisation chart (people, departments, etc.) as a declarative part against which some other informative parts must be checked. The three following sections illustrate this point.

Coherence in an Academic Site

Our first example is taken from the official Web site of Inria (http://www.inria.fr) as it was in July 2000. Research at Inria is organised in so called *research projects* (i.e. teams) that are classified by thematic areas (called *themes*). At this point, it is important to know that the organisation of research at Inria is dynamic: new teams are created, others are split or disappear rather frequently.

Figure 1 is a part of a Web page (translated here in english) presented as the official list of research projets at Inria in July 2000. We can see only a small part of this page that contains two columns: the first one contains a list of team names, and the second some brief descriptions of the research activities performed in the corresponding team.

THEME 1 : Networks and Systems

Programm 1A : Parallelism and Architecture

A3 (1)	Advanced Analysis and Code Optimization
APACHE(2)	Parallel Algorithms and Load Balancing
CAPS (3)	Compilers, Parallel Architectures and Systems
COSI (3)	Codesign of Silicon Systems
ReMaP (4)	Regularity and Massive Parallelism
TROPICS	Program Transformations for Scientific Comp

Programm 1B : Networks, Systems, Performance Evaluation

ARMOR (5)	Networks Architectures and Modeling
HIPERCOM	High Performance Communication
MASCOTTE (6)	Algorithms, Simulation, Combinatorics and OpTimization for TElecommunications
MEVAL	Modeling and Performance Evaluation of Com Systems
MISTRAL	Modeling in Parallel Systems and Communica Networks
PARIS (3)	Programming pArallel and distRibuted system scale numerical simulation applicationS
RESEDAS (7)	Software Environments and Tools for Telecommunication and Distributed Systems

Figure 1: Official list of research projects in July 2000

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Figure 2 is taken from a page devoted to the first thematic area and is older than the previous one. As we can see, the list of names is not the same as the one in the previous figure. Differences have been emphasised using a little bullet in front of the team name as the result of an experimental mechanical process. The names SLOOP and REFLECS, that appear on the second page, do not appear in the first one. This is because the activities of these two research teams have been reorganised. Most of researchers of the ex-SLOOP team belong to the newly created MASCOTTE one. The spelling of the name MEVAL is not uniform.

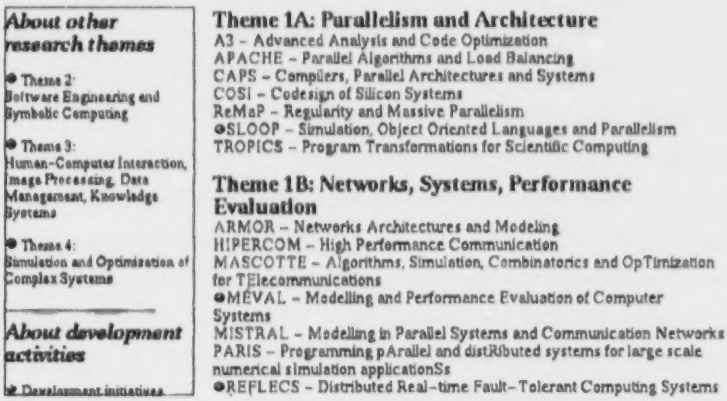
About other research themes
Theme 2: Software Engineering and Symbolic Computing
Theme 3: Human-Computer Interaction, Image Processing, Data Management, Knowledge Systems
Theme 4: Simulation and Optimization of Complex Systems
About development activities
Development initiatives
Theme 1A: Parallelism and Architecture
A3 – Advanced Analysis and Code Optimization
APACHE – Parallel Algorithms and Load Balancing
CAPS – Compilers, Parallel Architectures and Systems
COSI – Codesign of Silicon Systems
ReMaP – Regularity and Massive Parallelism
●SLOOP – Simulation, Object Oriented Languages and Parallelism
TROPICS – Program Transformations for Scientific Computing
Theme 1B: Networks, Systems, Performance Evaluation
ARMOR – Networks Architectures and Modeling
HIPERCOM – High Performance Communication
MASCOTTE – Algorithms, Simulation, Combinatorics and OpTimization for TElecommunications
●MEVAL – Modelling and Performance Evaluation of Computer Systems
MISTRAL – Modelling in Parallel Systems and Communication Networks
PARIS – Programming pArallel and distRibuted systems for large scale numerical simulation applicationSs
●REFLECS – Distributed Real-time Fault-Tolerant Computing Systems

Figure 2: Presentation of the first thematic area

As we can see with this example, the parallel with programming languages is easy. The first page (figure 1) can be considered as truthful and used as a declarative part to check the names that are used in the second page.

A Thematic Directory

Our second example concerns a thematic directory as it can be found in an internet guide: knowledge is classified using categories and subcategories. This tree structure can be presented in a single page or spread on many pages. In any case, an XML DTD can specify a syntactic structure in which categories and subcategories will fit.

But there is also a semantic relation between these categories: a subcategory must make sense in the context of its mother category, maybe by reference to a particular thesaurus. For example it seems reasonable to have `air` as a subcategory of `travel`, when `chocolate` is not. This cannot be specify by a DTD, but this constraint is in fact the one that gives sense to the global construction. In the same way, the content of a page that is referenced by a directory must fit the selected category. This means that, for example, a certain number of keywords in some metadata are related to the category or that, by text analysis, the document seems relevant in that category. This property is context-dependent: the same word may have very different meanings in the context of different upper categories. For example a slug in the context of animals does not have the same meaning that a slug in the context of arms manufacturing.

If it seems feasible to proof-check a thematic directory, it is quite difficult to maintain such a site. For some reasons, maybe by analysing the behaviour of users, one may have to modify not the syntactic structure, but the classification itself. If the semantics constraints have been formalised, a mechanical support should be possible.

Hypermedia and Annotated Documents

Semantic constraints are not limited to textual information. When information about a document exists (an RDF annotation for example), one may want to verify that this is coherent with the document itself. By comparing captions with some annotations on images, or by using some image recognition

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programs, many errors can be detected. In the same way we may also verify constraints on video or audio material. Note that, unlike in the domain of programming languages or in mathematics, proofs can not be completely formal.

Specifying and Verifying Semantic Constraints

As we can see, semantic constraints are very often global constraints (implying many pages and annotations), may use external resources (thesauri, ontologies, databases), and may use complex software (image recognition).

That is not the case for syntactic constraints that involve (for example in DTD) only local constraints (between a tag and its father). Moreover, semantic constraints concern the values of some parts of the documents, not only its literal representation neither its structure. To follow the parallel with programming languages, we can say that the authors of a Web site have not only to define the syntax they want to use (as a set of syntactic tags by means of a DTD), but also its semantics.

Some works take global constraints into account: WebMaster (van Harmelen and van der Meer, 1999; van Harmelen and Fensel, 1999), or works using attribute grammars (Psaila and Crespi-Reghizzi, 1999) for example. There are also specific programming languages to manipulate XML documents (Hosoya and Pierce, 2000; Meijer and Shields, 1999). We chosed to explore the *Natural Semantics* framework (Kahn, 1987) that is presented in the next section to specify and evaluate global constaints.

In our view, there is no fundamental difference between a Web site and a program. Proof-reading a Web site can be assimilated to program checking and it seems reasonable to investigate how works done in the software engineering area to prove and compile programs can be applied to the Web. The main difference is found in the data that are manipulated. When manipulating integers one can invoke some formal representation of the mathematical natural numbers. When we have to manipulate words or images, the underlying basement is more weakly defined.

Natural Semantics

Natural Semantics (Kahn, 1987) has been developed to specify the semantics of programming languages and to allow mechanical generation of compilers. It has two main goals: providing an executable semantic specification (Despeyroux, 1987) and allowing proofs. Its name comes from the fact that it is inspired by the Gentzen's sequents (Szabo, 1969) and the natural deduction style.

Natural Semantics manipulates an environment (a set of assertions, the hypothesis) and a set of inference rules or axioms that explain how to deduce some properties (known as consequents) using the hypothesis, mostly in a structural way.

The following two rules illustrate the example given in the previous section.

$$\frac{Name \in TeamList}{TeamList \vdash \texttt{<project>}Name\texttt{</project>}}$$

In this rule, we used some concrete syntax for the XML part. *Name* and *TeamList* must be understood as logical variables, not textual values. The tag `project` gives a syntactic type to the variable *Name*. The rule may be paraphrased as "if *Name* appears in the *TeamList*, then the text `<project>`*Name*`</project>` is correct in the environment *TeamList*". A more operational reading can be "Given a *TeamList*, the piece of text `<project>`*Name*`</project>` is correct if *Name* appears in the *TeamList*".

$$\frac{\textbf{makesense}(Name, CurCat) \qquad CurCat \cdot Name \vdash SubTree}{CurCat \vdash \texttt{<subcat><catname>}Name\texttt{</catname>}SubTree\texttt{</subcat>}}$$

This rule makes a call to an external predicate, **makesense**, to specify the semantic constraint between subcategories. It is not mandatory to specify everything by means of inference rules: an existing program can be used to manipulate a thesaurus for example.

A complete specification may manipulate many arguments, and must explain how one will construct the environment, not only how one will use it. In the context of Web site verification, one may distinguish

two main parts in this environment. The first one is information collected from the top (root) of the page to the current location (upper tags, arguments value etc.) and this functionality is very close to what is possible with XSL. A second part may contain information collected (or computed) not only in the current page, but also in the rest of the site. It can also contain references to external resources.

The specification is compiled into Prolog code to be executed. During this generation of Prolog code, new arguments are generated to be able to provide error messages and warnings.

Experiments

We have validated the *Natural Semantics* approach presented in this paper (Cherfi, 1999; Rai, 2000; Rineau, 2000; Despeyroux and Trousse, 2000) using the Centaur system (Jacobs and Rideau-Gallot, 1992) and Typol, the specification formalism that implements *Natural Semantics*. The initial goal of the Centaur system was to generate programming environments from programming language specifications: it has been used to study the semantics of many languages such as Fortran and Java or to generate environments for them. As we have already seen, there is not many differences between a programming language and any other formal language. As *Natural Semantics* manipulate abstract syntax trees (let's say typed terms) and logical variables, one will easily understand that the implementation language choice for Typol has been the language Prolog.

To relax some constraints due to the Centaur system, we have also made experiments using directly a Prolog system connected to a SAX XML parser. We made experiments both with XML documents and HTML (XHTML) documents in which the syntactic tags do not have any semantic meaning.

These experiments are positive, showing four main differences between the world of programming languages and the world of the Web that must be taken into account in future developments:

- Dissemination of information: in a Web site the information is much more disseminated over pages that it is the case in a program. In particular, cross-references are very frequent and declarations (facts) can be spread over many pages. A linear process of verification is not possible and this lead to specific incremental verification problems as we have to manipulate a great number of pages, taking into account that a Web site may evolve very rapidly.
- Use of external resources: the complete specification of a programming language can be done using Natural Semantics and Typol. This is not the case when dealing with the Web as we will need to use external resources and programs that must be easily combined with the formal rules.
- Use of heterogeneous objects: we need not only to manipulate Web pages, but also metadata (instances or schemas), images etc.
- Role of authors: a programmer needs to understand the semantics of the programming language that he or she is using. That does not imply that he is able to specify such semantics: this is the job of the programming language creator. In the world of the Web, the authors and webmasters are directly concerned by the meaning of their documents and by their semantic constraints. This means that the specification language must be easily accessible.

We have also to take into account the three following features that seem important in the context of Web sites specification:

- We need only to specify what are the points of interest. Using an inference system as *Natural Semantics*, we need at least to give one (recursive) rule for each tag; this should be a default rule. On the other hand, when several constraints are attached to the same tag, we would prefer to give several rules, not having to combine them in a big unique one.
- The environment (i.e. the set of assumption that can be used at a certain point) may be split into a local context (local to a page) and a global set of assertions. This feature can be used to perform an incremental verification of a large set of pages.
- The Constraints may be global to a site or limited to certain set of pages. It should also be possible to have some rules or constraints directly in the document itself and to group them according to multiple points of view, performing some partial checking.

Conclusion

Checking semantic constraints is crucial in designing and maintaining Web sites and thus in improving their overall quality. Our *Natural Semantics* approach was successfully applied to hypertext and semi-structured documents as Web sites (i.e. sets of XML or XHTML documents). It could also be applied to help in maintaining metadata, in particular RDF descriptions (that are also XML documents), and to verify the coherence between these metadata and the related documents. Future directions concern the design of a userfriendly specification language and its associated environment devoted to the specification of semantic constraints in Web documents taking into account the remarks listed in the previous section.

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Deriving Context Specific Information on the Web

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Abstract: The Web is huge, unstructured and diverse in quality, which makes searching for information difficult. In practice, few of the documents returned by a search engine are valuable to a user. Which documents are valuable depends on the *context* of the query. Some adequate context information provided in addition to keywords can improve significantly search precision. In this paper we propose a framework for dynamic conceptual clustering of web documents based on clusters of users that share common interests. The basic assumption is that the search results would be more relevant to a user when provided within the context of semantically related documents marked as 'interesting' by a sufficiently large group of users with similar interests. This framework can support personalization of a search based on a search engine that 'knows' the context of the user information needs and uses it to tailor the search results.

1 Introduction

The Web is huge and ubiquitous, unstructured, diverse in quality, dynamic and distributed, which makes searching for information principally difficult. General-purpose search engines that use keyword matching are notorious for returning too many matches of little relevance or quality in response to user queries. For example, if you submit the keyword "centroid" to Google almost 60,000 documents will be found. Which documents will be valuable to the user depends on the *context* of the query. The context depends on a number of factors, such as information related to the current request, user's interests, background, education, present professional activities, hobbies, travel and entertainment habits, etc. Search engines, however, treat each request independently from previous requests of the same user and of other web users making similar requests. Therefore the ranked list of documents received in response to the same queries is typically the same and depends neither on the user nor on the context in which the query is made. Some adequate context information provided in addition to keywords can significantly improve the search results. The question is *what type of context information is practical*, *how to infer that context information* and *how to use it* for improving search results?

Web users typically search for diverse information. Some searches are sporadic and irregular while others might be related to their interests and have more or less regular nature. An important question is then how to filter out these sporadic, irregular searches and how to combine regular searches into groups identifying topics of interest by observing the user behavior on the web. The fact that a user makes an isolated search for the size of Mars when solving a puzzle does not apparently indicate for any pattern of behavior while regular searches for papers on "Contextual reasoning" are more stable because they identify the user's current interests. Since the causal relations between the user's interests and actions for resource discovery are more stable, the latter are more predictive of user's future behavior. If we are able to identify *topics of interest* for a given user we can infer relevant contextual information associated with that user. Such contextual information when available to search engines could support personalized searches. Our approach to topic identification on the web is based on observations of the searching behavior of large groups of users. The intuition is that a topic of interest can be determined by identifying a collection of web documents that is of common interest to a sufficiently large group of web users.

In the present paper we present a resource discovery framework based on a contextual topology. A problematic point in the original web architecture is that there is no explicit conceptual partitioning of the web

information space. Present web communication assumes mainly *passive information* vs. *active users*. The framework we propose suggests dynamic conceptual partitioning of a portion of web information space into meaningful and more straightforwardly manageable units of information. Such partitioning of the information space would reflect the presence of groups of users that share common interests and possibly some common patterns of behavior. So, it assumes a parallel partitioning of users into groups corresponding to the overlapping objects of interest for each user group. Thus a partitioning of the *user space* into groups of users generates corresponding partitioning of the web *information space* into matching groups of documents. From these user groups we could derive the individual interests of their members to model a context of user's information needs. The partitioning of both spaces is viewed as dynamic and automatic clustering of web documents and users. Since the clustering of documents is based on overlapping interests shared by a sufficiently large group of users, we can assume that such a partitioning reflects the opinion conveyed to the information space by a typical member of each group.

2 Our Approach

Keyword queries cannot naturally locate resources relevant to a specific topic. Keywords perform poorly especially in situations in which the search index covers multiple subject areas, as is the case with "Internet" where Google returns 75,000,000 web pages. A promising technique is to guess the context of the user queries. Situations where a search is limited within a group of web documents (a topic) collectively selected by a user and his peers as 'appropriate' illustrate a *context* that is relevant to the current user's information needs. This type of context is also retrospective, because it reflects a portion of the history of the user requests. The fact that all users in a given group like a certain collection of articles is more stable and therefore more predictive than the fact that a particular user likes a given article. We can predict which articles would be of interest to a user based on the articles interesting to the other members of his group. One of the benefits of an explicit representation of a context is that it would enable us to localize the search within a relevant domain and thus to improve the search quality.

Typical search engines can be viewed as 'one size fits all' - all users receive the same responses for the same queries. This model is not always efficient. For example, when searching the web it is not always clear from a request such as "George Harrison" whether the user is looking for the famous "Beatle" or for the owner of the "Menswear of Quality" company. The ambiguity is due to the fact that the context of the search is not generally derivable from the request especially when each request is taken independently from other requests made by the same user. The major questions are: what type of context information is valuable and practical at the same time, how to infer the context information, and how to use this information for improving the search results? The framework for modeling context of user information needs suggested in this paper is based on the observations of documents being viewed (indicated as interesting) by web users. For a given group of users we refer to the collection of documents that are of common interest to all users of that group as a *matching group of documents*. Assume now that on the web there are user groups, from one side, and matching groups of web documents, from another. Then each user searching for information can perceive the web as a personalized list of search results ranked according to the current users' interests. Such a view is inherently *dynamic* as new documents arrive continually and the user groups are dynamic themselves. By synthesizing a conceptual context structure on the web specific to the interests of user groups, this framework provides a ground for a context-based resource discovery. For example, a contextual approach can support personalization of search based on a search engine that knows the contexts of user's information needs and uses that information to tailor the search results. Thus, a request for "George Harrison" may rank links to the owner of "Menswear of Quality" higher than links to the famous pop star for a user interested in stylish dressing.

Our method for topic identification on the web is based on observations of the searching behavior of large groups of web users rather than of a single user. The basic intuition is that a topic of interest can be determined by identifying a collection of web documents (articles, objects) that is of common interest to a sufficiently large group of web users. The assumption is that if a sufficient number of users $u_1,u_2,\ldots, u_m$ driven by their interest are searching independently for a collection of documents $a_1,a_2,\ldots,a_m$, then this is an evidence that there is a topic of interest shared by all users $u_1,u_2,\ldots,u_m$. The collection of documents $a_1,a_2,\ldots,a_m$ characterizes the topic of interest associated with that group of users. While the observation on a single user u who demonstrates interest in objects $a_1,a_2,\ldots,a_m$ is not entirely reliable judgment, the identification of a group of users along with a collection of documents satisfying the relation *interested_in*(u_i, a_j) is a more reliable and accurate indicator of an existing topic of interest.

In our approach contexts provide support in two aspects: *personalization* and *community formation*. Personalization refers to both individuals and groups and is based on automatic identification of communities with clustered topical interests. In contrast to directory services such as Yahoo where the web pages are assigned to categories manually, in the suggested framework the notion of context is viewed as a *self-organized* and *dynamic* structure. Self-organization means that the process of identification of existing groups of users and matching groups of documents is based on mining the users web experience for relevant data. Thus contexts are driven by inner dynamics, reflecting the fact that both user groups and matching groups of documents can grow and shrink over the time.

In a practical perspective the proposed approach for identifying a topic of interest is particularly appropriate for *specialized* search engines. First, specialized search engines are focused on finding information within specified fields, for example, Cora (http://cora.whizbang.com) is a search engine for computer science research papers. As a result the number of users of specialized search engines is considerably smaller compared to the number of users of general-purpose search engines. Second, specialized search engines use some advanced strategies to retrieve documents. Hence the result list provides typically a good indication of the document content. Therefore, when a user clicks on one of the documents the chances to get relevant information are generally high.

The question is: *how to gather realistic document usability information over some portion of the Web?* One of the most popular ways to get Web usability data is to examine the logs that are saved on servers. A server generates an entry in the log file each time it receives a request from a client. The kinds of data that it logs are: the IP address of the requester; the date and time of the request; the name of the file being requested; and the result of the request. Thus by using log files it is possible to capture rich information on visiting activities, such as who the visitors are and what they are specifically interested in and use it for user-oriented clustering in information retrieval.

The following assumptions provide a ground for the proposed framework. We assume that all users are reliably identifiable across multiple visits to a (search engine) site. We assume further that if a user clicks (saves/selects) a document it is likely that the document is relevant to the query or to the user's current information needs. Another assumption is that all relevant data of user logs are available and that from the large set of user logs we can extract a set of relations of the type: (user_id, selected_document). The next step is to derive from the extracted set of relations meaningful collections of documents based on overlapping user interests, that is, to cluster the extracted data set into groups of users with matching groups of documents.

3 A Formal Perspective

Given a set of users U, a set of articles (documents) A and a binary relation uFa (user u is interested in article a) determine a pair of subsets $U_I \in Pow(U)$ and $A_J \in Pow(A)$ such that

$$U_I = \{u \in U \mid (\forall a \in A_J)\ uFa\}, \quad A_J = \{a \in A \mid (\forall u \in U_I)\ uFa\}$$

That is, a topic of interest (U_I, A_J) is defined by a binary relation uFa ($interested\_in(u,a)$) and is characterized by the set of all articles A_J that are common objects of interest to all users in U_I.

From a formal point of view, the suggested contextual structure on the web can be interpreted as a binary relation between a set of users (U) and a set of articles (A), called *context*. Thus a context is a triple (U,A,F), where $F \subseteq U \times A$. Based on an analogy with formal concept analysis (FCA) (Carpineto & Romano 96; Wille 82), a topic of the context (U,A,F) can be defined to be a pair (U_I, A_J) where $U_I \subseteq U$, $A_J \subseteq A$ and,

$$U_I = \{u \in U \mid (\forall a \in A_J)\ uFa\}, \quad A_J = \{a \in A \mid (\forall u \in U_I)\ uFa\}$$

that is U_I is the set of all users interesting in all articles in A_J and A_J is the set of all articles that are common objects of interest to users in U_I. Exploiting further the analogy with FCA, A and U can be interpreted also as a set of *objects* and a set of *descriptors* correspondingly. Then A_J is the set of all objects possessing all the descriptors in U_I and conversely U_I is the set of descriptors held by all objects in A_J. We may think of the set of articles A_u associated with a given user $u \in U$ as represented by a bit vector. Each bit i corresponds to a possible article $a_i \in A$ and is on or off depending on whether the user u is interested in article a_i. The advantage of this interpretation is that now we can characterize the binary relation between the set of users and the set of articles in terms of *topic lattice*. Let us denote the set of all topics of the context (U,A,F) by $T(U,A,F)$. An ordering relation is easily defined on this set of topics by

$$(U_1, A_1) \leq (U_2, A_2) \leftrightarrow U_1 \subseteq U_2 \text{ or } (U_1, A_1) \leq (U_2, A_2) \leftrightarrow A_1 \supseteq A_2.$$

The set *T(U,A,F)* along with the "≤" relation form a partially ordered set that can be characterized by a *concept lattice* (referred here as *topic lattice*). Each node of the topic lattice is a pair composed of a subset of articles and a subset of corresponding users. In each pair the subset of users contains just the users sharing common interest to the subset of articles and similarly the subset of articles contains just the articles sharing overlapping interest from the matching subset of users. The set of pairs is ordered by the standard "set inclusion" relation applied to the set of articles and to the set of users that describe each pair. The partially ordered set can be represented by a Hasse diagram, in which an edge connects two nodes if and only if they are comparable and there is no other node - intermediate topic in the lattice, i.e. each topic is linked to its maximally specific more general topics and to its maximally general more specific topics. The ascending paths represent the subclass/superclass relation. The bottom topic is defined by the set of all users; the top topic is defined by all articles and the users (possibly none) sharing common interest in them. A simple example of user and information spaces is presented in (Tab. 1). The corresponding lattice is presented in (Fig. 1).

	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	.
u_1	1	1	1	1	1	1	1	1	.
u_2	1	1	1	1	1	0	1	0	.
u_3	1	0	0	0	0	1	0	1	.
u_4	0	1	0	0	1	0	1	0	.
u_5	0	0	1	1	0	0	1	0	.
u_6	1	0	1	1	0	0	1	0	.
u_7	0	0	0	0	1	0	1	0	.
u_8	0	0	0	0	0	1	0	1	.
.	.	.	.	.	.	.	.	.	.	.

Table 1: An example of user and information spaces.

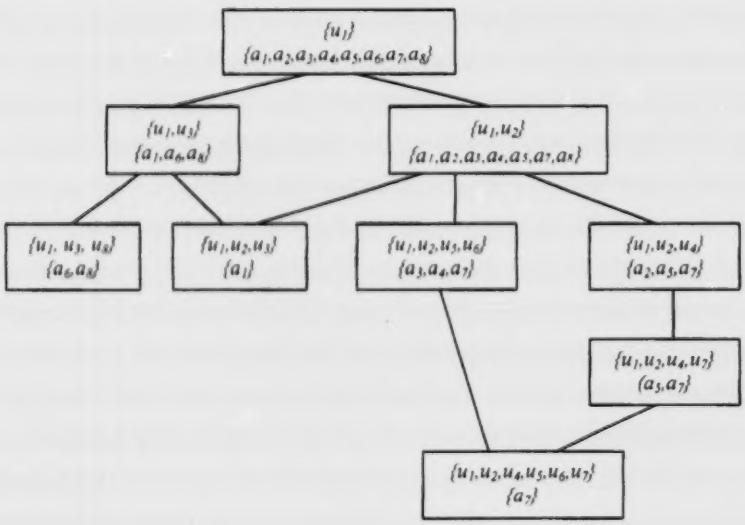

Figure 1: A lattice corresponding to the user and information spaces presented in Table 1.

In contrast to conceptual clustering (see Balabanovich & Shoham 97) where the descriptors are static, in the suggested approach the users who play a role of descriptors are *dynamic*: in general, a user's interest can not be specified completely and his topical interests change over time. Hence, the lattice describing the topical structure is dynamic too. This induces some results based on the following assumptions. A collection of articles

A_J from an existing topic (U_I,A_J) can only be expanded. This is implied by the conjecture that documents, which are interesting for a user u remain interesting to him. Therefore, an expansion of the collection of articles with respect to a topic (U_I,A_J) will not impose any change of existing links. Indeed, an expansion of A_J to A'_J results in an expansion of all parent (descendent)collections A_m, A_n, such that $A_J \subseteq A_m \subseteq A_n$, i.e. from $A_J \subseteq A'_J \rightarrow A'_m \subseteq A'_n$ and therefore $(U_n, A_n) \leq (U_m, A_m) \rightarrow (U_n, A_n) \leq (U_m, A_m)$. Analogous relations hold with ancestor nodes. That is, an expansion of an existing collection of articles preserves the structure of the lattice. The next assumption is a formal support of our intuition that the search domain relevant to the user $u \in U_I$ includes a subset of articles to which other members of the group U_I have demonstrated interest. These are collections of articles A_K of the topics (U_M,A_K), such that $u \notin U_M \cap U_I \neq \emptyset$.

One of the main factors in a page ranking strategy involves the location and frequency of keywords in a web page. Another factor is link popularity - the total number of Web sites that link to a given page. However, present page rank algorithms typically do not take into account the current user and specifically user's interests. Assume that we have partitioned users into groups associated with their topics of interest (as collections of documents). A modified ranking algorithm can be obtained by extending the present strategy with an additional factor involving the number of links to and from a topic associated with a given user. In this case the page ranking strategy takes into consideration user's interest encoded in the number and the levels of links to a topic associated with a given user. So, for a user $u \in U_I$, where (U_I,A_J) is a topic, the page rank of an article a should depend on the linkage structure to the articles $a_i \in A_J$ representing the topic of interest of user u .We can interpret a link from page A to page B as a vote of page A for page B. Thus votes cast by pages that are from the users topic weigh more heavily and help to make other pages 'more-important'. This strategy makes page-ranking *user oriented*. Such a strategy promotes pages related to users' topics of interests. From an "active users" perspective this approach enables us to recognize a community of users for which a given article is most likely to be interesting.

This approach suggests also an ordering relation $(\prec)$ for ranking articles returned in response to a request from a user u, assuming that U_I is the maximally general group such that $u \in U_I$. Thus $a_1 \prec a_2$ if there exist collections A_1 and A_2, $a_1 \in A_1$, $a_2 \in A_2$, where A_1 and A_2 are components of existing nodes (U_1, A_1) and (U_2, A_2), such that $U_1 \cap U_I \neq \emptyset$, $U_2 \cap U_I \neq \emptyset$ and $|U1| < |U2|$, i.e. the more members of the group U_I have expressed an interest in a given article the better. The later ordering relation can be incorporated into the suggested ranking method.

An important characteristic of the method is that it does not require explicit representation of the Web objects, due to the fact that it exploits "membership" relations. The set of objects A_u are identified based on their relevance to the context "interesting to the user u", rather than on specific syntactic properties of their representations. Therefore it can cover objects behind the conventional search forms, such as pdf files, images, music files, and compressed archives. In many cases the user is not certain of what information exactly to look for and needs to learn more about the content of the information space. In such cases browsing a collection of documents generated on the base of the current context can be a good navigational strategy. Thus this framework supports information retrieval based on contextual browsing, where user $u \in U_I$ can navigate through the matching collection of articles A_J.

4 Related Works and Conclusion

The Web is probably the richest information repository in human history, but it is usually hard and time consuming to find desired information there. The low precision of the web search engines due to the lack of contextual knowledge makes it difficult to find relevant information. The focus of the current efforts of the Web research community is mainly on optimizing the search, assuming active users vs. passive information.

Recently there has been much interest in supporting web users through collecting web pages related to a particular topic (Brin & Page 98), (Chakrabarti et al. 99), (Mukherjea 00). These approaches aimed at topic specific resource discovery typically exploit connectivity for topic identification but not community identification. Community identification does not play any significant roles in these methods and therefore user search experience within a community is ignored. Some systems such as (Kumar et al. 99) do exploit the experience of other web surfers to derive clustered topical interests but the focus is on organizing surfing history in coherent topics for later use. The problem of identifying community structure on the Web was addressed in (Kumar et al. 99). However, the approach employed for community identification is based on analysis of the Web graph structure and is not explicitly related to resource discovery. In collaborative filtering systems (see Balabanovich & Shoham 97) items are recommended on the basis of user similarity rather than

object similarity. Each target user is associated with a set of nearest neighbor users (by comparing their profiles) who act as 'recommendation partners'. These systems are aimed at recommending items from a fixed topic/database. In contrast, our approach is aimed at large scale resource discovery based on derived topics reflecting similarity of interests among users. A derived benefit of such an approach is localizing the search within an individual topic of interest. Categories and formal concept analysis (Carpineto & Romano 96), (Wille 82), modeling and using contexts (Dichev et al. 01), (Lawrence 00), (Glover et al. 99) have been studied for a long time, motivated by the need for a formalization of the notions of concept and context. A major practical issue is the level at which contexts are defined and analyzed. The context information used in Inquirus 2 metasearch engine (see Glover et al. 99) is in the form of category of the desired document. The context is used to select the search engines, to modify queries and to select the ranking strategy. Our framework is close in spirit to the application of Galois' concept lattices (Carpineto & Romano 96), but the grouping of web objects into classes is based on dynamic descriptors associated with web users.

In this paper we have presented a novel framework for information retrieval on the web. The basic assumption is that the results of a search would be more relevant to a given user when provided within the context of semantically related objects marked as "interesting" by their peers. In addition, a contextual structure would help users in getting better insight about the scope of their search, localizing the search, reducing the amount of time for deciding on the relevance of the hits of a search, comparing the hits to objects selected by their peers, optimizing the search strategy, etc. An additional advantage of the presented approach is that the topical clustering can cover objects behind the conventional search forms including non-indexed web objects, such as pdf files, images, music files, and compressed archives. By partitioning web users into groups it would be possible to make useful predictions about some other shared features and patterns of users' behavior and derive some correlating properties regarding the web information space. Moreover, the identification of significant groups of users with similar interests can help producers of information to reach interested consumers in a timely manner.

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Constructivist Use of Interactive Digital Video: Encouraging Students to Apply the Principles of Educational Psychology to a Web-Based Interactive Teaching Exercise

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Constructivist teacher educators can introduce preservice education students with the experience of applying the principles of educational psychology to real-life situations by providing a technology-aided project. Just such a project was undertaken when preservice education students were provided with a desktop computer with digital video editing software and a digital video camera. The students proceeded to investigate (through classroom discussions and a review of the literature) the value of the principles of educational psychology. They then constructed their own understanding of how the lessons from the literature could be "brought to life" by writing, producing, and acting in teaching scenarios that were then converted to web-based interactive digital video teaching exercises. For these teaching exercise scenarios, students provided a brief "stem" video clip demonstrating a teaching situation. Typical teacher reactions to the situation (representing different applications of various psychological principles) were then provided with prompts asking the user to select the best teacher response. In the process of constructing this web-based interactive digital video teaching exercise, it was intended that students construct their own knowledge of the benefits of applying the principles of educational psychology. The resulting project was then placed on the Internet so that other preservice, and inservice, teachers could benefit from these exercises.

Improving Collaboration in Web-based Distance Higher Education Using Synchronous Technologies

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Abstract: This paper describes the development of an online course in Microelectronics by implementing live sessions and online discussions. The main goal of this implementation is to increase the learning process efficiency by fostering the collaboration between the instructor and the students as well as between the students. The pilot run shows that following this approach the average final mark increases while the average completion time decreases resulting in a higher student's level of knowledge.

1. Introduction

The course was initially implemented in an asynchronous way using the Core Module of LOTUS Learning Space 4.01 (LLS) environment and was run for two academic years in the Department of Electronics, University "Politehnica" of Bucharest. The text-based course material was reorganized in a larger number of chapters in order to better keep trace of the students' assessment. Some chapters have laboratory work that was implemented in an online manner by means of web-based interfaces that were designed for all the simulation tools used within the lab. These interfaces allow a student to launch remotely a job using a low cost Pentium based computer.

2. Synchronous implementation

The decision of combining asynchronous with synchronous activities within a web-based distance course was taken after the first two years of running the pilot in which we saw a major increase of the laboratory completion time and, more important, a decrease of the average final mark compared with the period in which the course was taught in a face-to-face manner.

Using the Collaboration Module of LLS we implemented live sessions as well as online discussions within the course. The live sessions are facilitated by an instructor, and require all students to be logged on during a time period determined by the instructor. In a live session, instructors presents to students text and graphics on a Whiteboard, real-time applications that appears in a window on each student's screen and/or ad hoc classroom questions that each student can see on the screen. Online discussions allow real-time interaction between course participants. This way design projects and theoretical problems can be discussed without any delays. At the beginning of the course these facility is frequently used by students for getting known each other. Online discussions do not require all course participants to be logged on the same time.

Figure 1 presents a live session in which the instructor uses the Whiteboard facility showing the students how to use a device simulator.

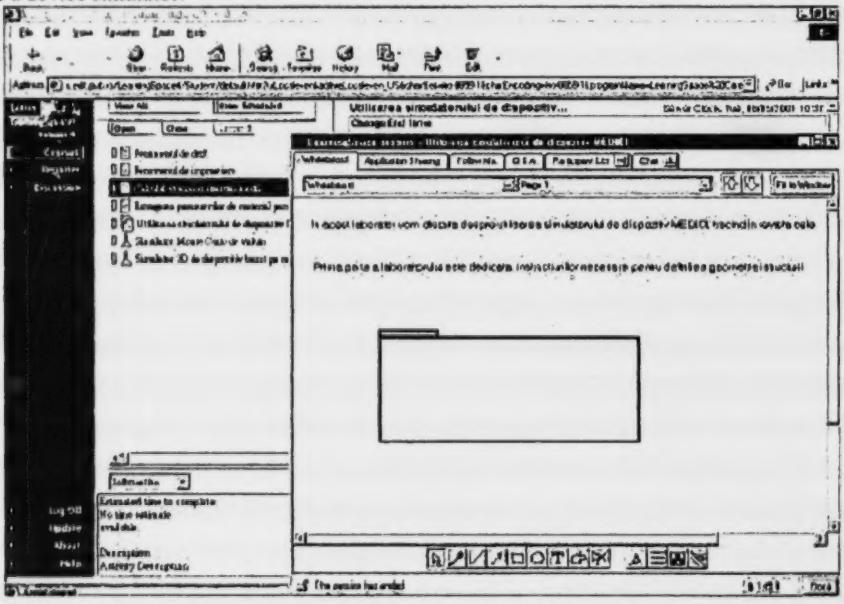

Figure 1: Screen snapshot of a whiteboard session

3. Conclusions

The implementation of synchronous activities within a web-based course allows a better interaction between the students and between the students and the instructor resulting in better grades and shorter completion time. The pilot run shows an increase of the average final mark compared with the last academic year with 9.7% while the average completion time decreases with 19.3%.

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Optimizing Web Pages for Instruction

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Abstract: Through a hands-on demonstration and discussion, this brief session will cover the basics of web page design and creation and explore further ways to ensure a worthwhile Internet experience. Included will be at least ten important and very useful tips and tricks about web development and web page optimizing techniques that successful web designers use when creating instructional-informational web pages for readability and functionality. Specific suggestions will be demonstrated for image optimization and suitable use of graphics, the implementation of tables and the target tag, the appropriate use of background images and colors, the necessity of a clear navigational layout, and techniques for search engine optimization, debugging, and proper monitor display. The level of instruction will not be highly technical, but appropriate for general audiences. From novice to expert, attendees will discover ways to use the Internet to enhance a Web-based, online curriculum.

Summary: Ten Important Optimizing Techniques for Web Page Development

The following summarizes, in outline form, the 10 web page design and creation tips that will be briefly discussed in the short paper session:

1. Optimization of Graphics – why optimize?
2. Other Image Issues – Do's and Don'ts
3. Tables Issues
4. Text Issues
5. Use of Background Images/Colors
6. Links - Use Targets
7. Layout and Navigation
8. Titles and Search Engines
9. Debugging
10. Browser, Monitor, and PC check

Questions to Ask About the Effectiveness of One's Own Web site(s)?

1. Can users find what they are looking for - easily and quickly?
2. Is content useful, informative, fresh, updated regularly?
3. Is the content structured specifically for the Internet experience?
4. What is its purpose? ($, informational, or ego-focused)
5. Are graphics fast-loading and appropriate?
6. Is the 'look and feel' visually attractive?
7. What are the possible sources of frustration?
8. Would users want to come back?

CAUTION: You only have about 7 seconds to get a user's attention!!

Learning Objectives

Participants should come away with an enhanced understanding of web design and development, new skills, and knowledge of several outstanding Web-based resources and tools at their disposal.

Some Recommended Web Page Resources

Anne's World:
http://www.wwnet.net/~ahartman/

Sucky to Savvy:
http://jeffglover.com/ss/ssmain.php

HTML Goodies:
http://www.htmlgoodies.com

Tips-Tricks: How To and Beyond:
http://www.tips-tricks.com

Web Design Tools and Tips:
http://www.supersoft-solutions.com/

Bravenet.com
http://www.bravenet.com/reviews/build.php

Eons.org: Webmaster Resources Index
http://eons.org/

Banner, Button, and Logo Creator
http://www.crecon.com/banners/

HTML Clinic
http://www.htmlclinic.com

Online Access

A similar presentation, given by the same author, was delivered at the National Education Computing Conference (NECC) in Chicago, IL in June of 2001. The Powerpoint presentation may still be accessed by visiting: http://www.eboard.com/. Type 'necc-2001' (don't include quote marks, case-sensitive) into the "Enter an e-Board" text box, and then click on the hyper-link to access the page with the Powerpoint attachment (approx. 1MB).

Presenter Information

The presenter, Tim Dirks is the Manager of Online Courses and Training for the non-profit Institute of Computer Technology in Sunnyvale, California. He has over 20 years experience in the areas of teaching, counseling, and technology. His areas of expertise include the integration of applications into classroom curriculum, technology in education curriculum, and Web site development. Currently, he is the manager and online curriculum developer (for an instructional technology certificate program for K-12 teachers with three major university partners – see http://www.ict.org/onlinehome.html for additional information), web site manager and author (of an award-winning site on Hollywood films, http://www.filmsite.org/), and technology trainer (classroom-based and online with the Institute of Computer Technology, http://www.ict.org/).

Prior to joining the Institute of Computer Technology, he was the Public Programs Manager at the Tech Museum in San Jose. He has a Masters Degree in Religion from Yale University, a Masters Degree in Education from Stanford University, and a California Life Teaching Credential.

If they ask you to put your course online over the weekend, tell them to take a hike

Dr. Patricia Stevens, Jackie Dobrovolny, Sandy Kent, Kerri Shulman

Abstract: This presentation focuses on the development of an online, graduate course entitled Marriage and Family Therapy. This course was a traditional, face-to-face, class, offered by an urban university. The professor who teaches this course worked with three graduate students during the Fall, 2000 semester to design and develop the online version of this course, which she then taught during both the Spring and Summer 2001 semesters. In addition to describing the development process, this article summarizes lessons learned and keys to successful online graduate instruction.

The Marriage and Family Therapy course is an introductory theory class in marriage and family counseling. It requires students to shift their worldview from linear to systemic thinking. The objectives of this course are to: (1) introduce the student to an understanding about relational and systems paradigms; (2) introduce the major systems theories; (3) expose the student to family life-cycle development, healthy family functioning, diversity, and family-of-origin issues; (3) examine the roles of marriage and family counselors in a variety of practice settings; (4) observe various theories in use; (5) examine professional issues such as training, supervision, and ethical concerns; and (6) integrate theoretical concepts using the student's family of origin.

In the traditional, face-to-face class, the professor provided an overview of the major theoretical orientations in systems therapy. In written assignments, as well as in small group discussions, students examined their own family dynamics to identify personal issues that might hinder or assist their ability to work with clients. To understand the theoretical constructs of different counseling theories, students used examples from their own family history and watched videos of experts applying different theories. They also worked in small groups to analyze several different cases from several different theoretical perspectives. Additional assignments included a current research issues paper, a midterm, and a final examination.

There were two major reasons for developing an online version of the Marriage and Family Therapy course. First, the online course needed to provide students in rural areas the opportunity to participate in the program without having to travel long distances. Second, the course is an introductory course taught by several professors in the counseling department. The online course had to be structured so that these various faculty members could easily teach the online version of the course.

The challenge in the design of the online course was to maintain the integrity and instructional quality of the traditional, face-to-face course. It was especially challenging to create the discussion segments of the course that relate to the student's own family. We used the eCollege℠ course management software to develop this course, which resides on the eCollege server. The specific eCollege features we used were the Webliography℠, Document-sharing, the Journal, and the Threaded Discussion.

The Webliography and Document-sharing features allowed students, the professor, and the teaching assistant to share course related resources. The Webliography℠ contained links to the Internet. Students, the professor, and the teaching assistant can all add relevant information to the

Webliography. One of the assignments was for students to add five new relevant websites during the duration of the course. In addition to the URL, students provided a brief description of the site and rated its usefulness on a five point Likert scale. The Document Sharing feature allows students, the professor, and the teaching assistant to share word processing documents, images, spreadsheets, etc. The professor posted sample assignments in the Document Sharing section of the course to help students understand specific assignments and to provide alternative ideas for completing each assignment. Students shared their papers with each other by posting both drafts and final papers in Document Sharing (Lamb & Smith, 2000).

The family of origin analysis was one of the major assignments in the Marriage and Family Therapy course. This was often a difficult assignment for students due to the personal nature of the questions and sometimes the emotional reaction to addressing these issues. The eCollege Journal feature allowed students to share their family origin assignment with the professor, who could add comments and responses to the student's journal entries. Students could choose to share their journal entries with other students or with just the professor.

The Threaded Discussion feature allows students to post responses to a discussion question and respond to the comments posted by other students, the professor, and the teaching assistant. The online Marriage and Family course used this feature several times during the semester to help students manipulate the course content, thereby making it personally meaningful, and to explore alternative ideas and perspectives. The threaded discussions were also an opportunity for students to interact and communicate with the professor. This student/faculty interaction is a critical aspect of quality online instruction (Graham, Cagiltay, Lim, Craner, & Duffy, 2001; Shank, 2000).

Threaded Discussions were an integral part of the "lectures" in the online Marriage and Family Therapy course (Rohfeld & Hiemstra, 1995). Three guest lecturers, who were practicing marriage and family therapists, each lead a discussion during one week of the course. These experts provided electronic documents or journal articles, which students used to prepare for each discussion. Additionally, the professor assigned several journal articles she had published. Those articles were on the professor's professional website and students linked to each article from the course. This strategy allows other professors, who might teach this course in the future, to merely change the links thereby using their own articles or lecture notes. Videotapes, which were on reserve at the university library, were also used as a type of course lecture.

The course provided for large classes to be divided into small groups, similar to the small groups used in the traditional, face-to-face course. Each small group has its own threaded discussion where students share with each other descriptions of their family dynamics and compare and contrast their family structure, roles, rules, and issues. These small group discussions originate from each student's family of origin assignment but students may choose to not reveal in these discussions everything they included in that assignment. Each small group also has its own Document Sharing section where students can share resources with just the other students in their group.

To replace the current research issues paper, which was assigned in the traditional, face-to-face course, and to facilitate more student interaction, the professor assigned a more practical, less research oriented paper in the online course. During the first week of the Spring 2001 class, the professor asked the students to select a target population for their papers, i.e., either the general public or graduate students. The students selected the general public. Each student then selected a specific topic relevant to marriage and family counseling, researched that topic, and wrote a short paper. Using the Document Sharing feature of eCollege, students analyzed each other's papers and provided feedback and suggested revisions. Students then revised their own papers and submitted them to the professor for grading. The final papers will be posted to a public website.

Development Process

The team who developed the online Marriage and Family course consisted of the instructor, her teaching assistant, and two instructional designers from the Technology and Learning Team (see next section for more information on TLT). During the first meeting, in August of 2000, the professor explained that she had been asked to develop four online courses for the Spring 2001 semester. We decided that it was impossible to design four effective online courses in one semester, and instead agreed to design one course for the Spring semester and then design another course during the spring for the Summer semester. We also decided to design the Marriage and Family course first and we created a team agreement that outlined the roles and responsibilities of each member of the group.

Generally, we met once per week for about 1.25 hours. During our next few meetings, we evaluated different online course management software products. We selected eCollege primarily because they provide 24/7 technical support to students and professors and because it was one of the online course management products supported by our university. The next step was to convert the major components of the traditional class to an online environment. The components with which we were particularly concerned were:

- The small group discussions of the family of origin assignment
- The case study assignment where student groups review cases from several different theoretical perspectives
- Guest lecturers
- Midterm and final exams that were designed to help students prepare for the state board examination.

Another concern in the development process was how to show the videotapes the professor used in her traditional course for case study work. We considered many options for distributing the videotapes, including streaming video, digitizing the videotapes and distributing CD-ROMs, and using a distribution service to copy the videotapes and distribute them directly to students. The challenge we faced was obtaining copyright permission from the owners of the videotapes. For a variety of reasons, none of our options was successful so we temporarily sidestepped this issue for the Spring and Summer 2001 semesters by placing the videotapes on reserve in our campus Media Center.

By November, our team was ready to learn eCollege and to put content into the course shell. Three of our team members attended formal training at eCollege. The team worked together to learn the technical aspects of eCollege and to design the course to take advantage of the various eCollege features. As we added content to the course, we worked with a graphic designer, from the Technology and Learning Team (see below for more information on the Technology and Learning Team), to include visuals and the professor added copyright-free clip art. Many of the visuals were in the weekly introductions, which are short motivational documents. The teaching assistant entered over 300 test questions and reviewed the course as a student to look for inconsistencies and problems. Specifically, she was making sure potential students knew what they needed to do each week and what was expected of them. The teaching assistant repeated this formative evaluation several times during the development process.

As a team, we spent approximately 400 hours developing the online Marriage and Family Therapy course. The professor spent approximately 200 hours, her teaching assistant spent approximately 80 hours, and the two graduate students from the Technology and Learning Team spent a total of approximately 120 hours.

Technology and Learning Team (TLT)

The TLT mission is to assist the faculty in the effective use of instructional technologies. Thirteen graduate students, primarily from the Information and Learning Technology program in the School of Education, staff the TLT and each generally works 15 to 20 hours per week. There is one full-time staff member. For more information on the TLT, please see their website at www.tlt.cudenver.edu.

Lessons Learned

Student evaluations of the online Marriage and Family Therapy course taught during the Spring 2001 semester were very positive. After the fifth week of the course, students reported that they were pleased with the workload and very satisfied with the interaction with both the professor and the other students. They also reported spending an average of six hours per week working on assignments and readings for the course. Not attending a traditional class or having face-to-face interaction was not a problem for these students. Hardware/software problems and the amount of time required to complete the writing assignments were of moderate concern. As expected, convenience was the major reason for taking the online course, however, knowledge of the instructor was also an important determinant. Students were "highly satisfied" with the course as a learning experience.

At midterm, all students indicated that they were "satisfied" with the online course at that point in the semester and 66.7% reported the course sequencing and assignments were easy to understand and follow and that the pace of the course was "about right." Unfortunately, 66.7% of the students reported significant technical problems that "interfered with their learning."

At the end of ten weeks, students completed another evaluation. Generally, students continued to be positive about all aspects of the course but there was a slight drop. Anecdotally, this dissatisfaction seems to coincide with the same dissatisfaction students express in traditional, face-to-face courses as they approach the 10-12 week point in the semester.

The use of videotapes was, and continues to be, problematic. First, we were unable to obtain copyright permission for the videotapes we used in the traditional, face-to-face course or to establish a distributor for those videotapes. Some developers of online courses upload videos or copy them to CD-ROM without permission but we decided not to do this. As noted above, our temporary work-around was to put these videotapes on reserve at the university Media Center. We are currently investigating alternatives, as the online Marriage and Family course will soon include students who are outside our metropolitan area and thus, can not get to our university. Another problem with the videotapes is if we obtain the resources necessary to put the videos on the Web, our student's Internet connections may not be sufficient to support video streaming. Perhaps our next work-around is to obtain permission to copy the videotapes to CDROM and distribute those CDROMs to the students.

Selecting the best course management software is another important issue in the design of online instruction. We chose eCollege mainly because of the 24/7 technical support and the support our university provided for this product. The technical support both the professor and her students received from eCollege was excellent. Our advice to others is to test the features you need in your course, in the various course management products you consider using. Just because a course management system claims to have "chat," for example, or document sharing, does not mean that feature works as you need for it to work for your unique course design. Also consider the Internet browers and the Internet Service Providers (ISP) you and your students use. Some course management systems work better with some browers and/or some ISPs.

The experience of developing this course was an intellectually stimulating adventure for everyone on the development team. Team members provided their individual strengths to the endeavor, creating a dynamic atmosphere. The process was time consuming and demanding, but well worth the effort, as well as being an enjoyable experience.

It is important to stress, however, the intense time commitment required to develop a quality online course (Creed, 1996; Eiler, 2000; Lamb & Smith, 2000; Smith, 1997). In addition to learning the idiosyncrasies of a particular course management system, the paradigm shift is particularly difficult and it takes time to work through these new ideas. It also takes time and patience to input the course content. Finally, the delivery and implementation of an online course is very time-intensive. A high level of team interaction and support is, therefore, necessary throughout the entire course development and delivery cycle. University administrators often are not willing or able to provide the financial or time resources necessary to develop and deliver effective online instruction. When faculty are asked to develop online courses and continue with their normal workload, instructional quality may suffer, as well as faculty enthusiasm and morale.

In summary, we believe that it is imperative to have sufficient time, support, and resources to design and develop quality online university courses. Adequate time to develop the course in a thoughtful manner and to address the inevitable paradigm shift is critical. Technical training for faculty and funds for graduate assistants to help with both the development and the delivery of the course are also imperative. Finally, resources to take advantage of the electronic medium are necessary. For example, in the case of the online Marriage and Family course, we still need funding to create video case-study samples and/or to purchase the appropriate copyrights for the videotapes used in the traditional, face-to-face course.

There is no doubt that higher education must create a variety of course delivery mechanisms in order to stay competitive in the 21st century (Menninger, 2000). "Although the primary mission of the university -- the creation, preservation, integration, transmission, and application of knowledge -- are not changing, the particular realization of each of these roles is changing dramatically" (Duderstadt, 1997). We must also recognize, however, that in addition to variety, we need quality. This undoubtedly will require both university administrators and faculty to reassess many of their assumptions about the process of designing, developing, and delivering university instruction.

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Biographies

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Beyond Mythology to Technology

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Abstract: Making the leap to a technology -enhanced, on-line educational experience has been a four- year labor of love for the *NatureShift! Linking Learning to Life* project. What began as a Technology Innovation Challenge Grant designed to get technology and hands-on learning out to an information isolated highway of communities, schools, parks, museums, and other formal and non-formal educational settings turned into a true test of metal for learners, educators, community volunteers, and instructional designers alike. The paper will discuss lessons learned in building an educational website and tapping the talents of partners, community, and other technology projects nationally. In its past three years, the NatureShift project has taken technology training to educators, taught pre-service teachers, and built a technologically advanced web site for delivery of instructional materials, tutorials, tools, and collaboration. The project has stretched out to the rurally isolated, crossed gender and cultural learning barriers, and embedded new software products from other projects around the country into its on-line curriculum. Yet the biggest barrier the project faced has been surmounting the mythology surrounding technology. The project had to leap over the mythos and learn to use technology, not as a tool, but as a springboard for interaction and self-actuated learning.

The paper will show how the more the project tried to create an educational web site and teach educators how to use new technologies and the more the project tried to improve on the latest technology available, the farther back it fell into the self-generating myths surrounding technology. Most educators have heard the mantras: Technology IS the curriculum; Technology makes learning fun; Technology puts learners in control; Technology is easy; Technology is hard to learn; Technology makes teaching better…more efficient…more productive, ad infinitum. NatureShift studied the rocky terrain, learned many of the pitfalls first-hand, and finally made the leap to step over the cloud of "learning technology." What the project discovered was that, by itself, technology can neither do nor be any of these things. The most lasting lesson NatureShift learned was a finely-wrought skill for hiding technology within learning environments. The result: The imaginations of project educators, student teachers, and partners have opened to a new world of learning. By having instructional designers build the content to the technology and then training the content, not the technology, to educators in the field (whether pre-service or in-service, formal or informal), provided the key to good on-line curriculum and a successful method of training. The results are hinting at a dynamic link that takes place between learner, technology, and learning as soon as the technology begins to disappear.

Pedagogy The computer and the Internet have radically changed the face of traditional educational technologies and with their introduction into education these new tools have also affected what we understand about teaching and learning. The computer crept slowly into education in the mid-twentieth century, at first for machine-like conversations with humans that mimicked the lock-step robots of the assembly line, computers were for "programmed instruction"[1] (Goldsworthy 2000, Skinner 1958). Eventually, however, computing peppered the landscape of learning and tossed in its own instructional rules into the process that suggested technology could aide learners in constructing meaning from the learning process (Harper *et al.*, 2000). The recognition of ways technology gives learners control over much of the learning environment challenged the educator's traditional role. The ability of the learner to interact with the content, to reorder it, reshape it, or question it, at his or her discretion meant that educators had to revise their most core concepts of teaching, relearning how to shape an instructional experience in this new environment (NCES, 1999). This landscape required multidimensional as well as multimedia construction (Havinga 2000). Not only was a teacher faced with the challenge of framing a lesson plan according to new principles, they had to design instruction that could be delivered through this foreign medium of technology and learn new rules of engagement – to understand how students interacted with technology for learning (Elkind 2000).

The use of the new technologies in framing instruction, first the computer and later the Internet, gave the learner freedom to create personal learning goals and eventually build new learning constructs. However, these glamorous new tools quickly developed their own mythology. The computer, the digital camera, the informational technologies of the Internet solicited more interest than the work they were created to do. Learning got lost in the glamour. These new technologies also came with learning curves. Educators either embraced them as exciting challenges or evaded them as impediments to the instructional process.

[1] Programmed Instruction, a term referring to drill and response instructional exercises programmed into early computers with feedback stamped out on punch cards. Learners performed drills until they mastered the content. The practice was introduced to education during the 1950s when B.F. Skinner's *stimulus and response* educational theory was at its height.

NatureShift was designed to employ and infuse new technologies into its model and its methods. Its mandate to bring technology and its training to educators from the vastly different worlds of formal classroom education and informal free-choice educational settings was a monumental goal. *NatureShift* was faced with a double-edge challenge: to train educators in the use of new technologies and, at the same time, in a new model for teaching and learning with technology. What the project discovered early was that professional development for educators required debunking the technology myths that impeded learning new methods and practices.

Importance of the Study New national technology standards for students and teachers coming out of ISTE[2] as well as other organizations are being accepted nationally by accreditation organizations such as NCATE[3]. These have raised the bar for pre-service teacher education and are rapidly pressuring for adoption of higher technology standards by public schools nationwide. The educational community is being asked to increase technology access and implement rigorous technology profiles throughout its schools and universities even as it struggles with implementing best approaches to training its educators. Add to the picture a technological landscape that keeps growing and changing and the importance of successful training methods becomes paramount. The *NatureShift* experience has shown that the challenge for building instruction through technology and training teachers in its use is indeed great and there is not an easy answer. Nevertheless, we have seen trends that suggest there are rules that work in this new landscape. One finding of particular note has been the discovery that difficulty with or resistance to technology could be surmounted by concentrating training and curriculum not on use of technology but on accomplishing tasks that are known. By modeling technology use, empowering teacher-learners to put hands on the technology, and integrating the technology with meaningful tasks clearly worked during training and on the web sites.

The *NatureShift* Challenge

The *NatureShift* project has 10 pilot site partners who implement the *NatureShift* "Exploration Model"[4] using curricular content from five cross-disciplinary education modules. Five pilot sites are formal school environments, and five are informal (or free-choice) educational environments (parks, libraries, and museums). The project provides professional development in the model and the technologies to educators at all sites. At the start of the project, *NS* educators approached professional development using known methods of training. Those methods included trainer-to-trainee instruction and hands-on activities to learn the technologies (computer hardware, educational software, scanners, QTVR production, and video camera). Teachers were given specific tasks to learn the technologies and then specific tasks to learn the ingredients of the model, all new content for teachers to learn but doing so using instructional practices that were very familiar. This approach quickly introduced educators to new technology. Teachers learned to use the video camera and they were thrilled. Sometimes they learned effective strategies to integrate the camera into their instruction. The same for learning the computer and other new technologies. Practice in creating technology-enhanced instruction that followed the precepts of the *NS* model met with the same results. Teachers learned to set-up a lesson by engaging students with an authentic situation or *Task*. They built *Web Adventures* so their students could learn how to research using the Internet. They loved learning to construct Real World Adventures that put meaning into students' understandings. They learned to design multimedia projects or portfolios that taught their students to construct meaning from their learning. Yet, after every *NS* site training or conference workshop, participants failed to retain most of the knowledge they had gained. Worse yet, trainees had more problems when they returned to their sites. Either the technology failed or they could not remember how it worked, and they had no time to redesign curriculum or even a lesson plan that incorporated new technology. If they did not get enough training at the workshop, the technology did not get used.

By the start of the grant's third year, the project was faced with a dilemma. Staff was modeling new technologies. They were modeling innovative teaching and learning strategies. Yet, knowledge was not being retained. Teachers did not remember the technology at follow-up workshops, nor were they demonstrating any ability to transfer knowledge gained to new situations. At partner workshop after workshop, the same questions and issues arose. "Technology is too hard to learn.... It always breaks down.... I don't have time in my day to do all this creative planning... I can't teach students to use a technology I don't understand... I don't know what I'm supposed to do with this technology."[5]

Lessons Learned In year three of the grant, the project changed course. *NatureShift* sponsors several workshops throughout the year, including two professional development workshops for partners. Each workshop and training includes surveys and self-assessments for participants to evaluate their learning. Although a formal statistical analysis of data will not be completed for another year, an anecdotal review of participant comments, taken in fall, 1999 revealed a common response. Participants were asking for *application* training. They wanted to know *how* to apply the *NatureShift* model, not how to use technology to implement the model. In response, the project tested a new training approach during its January 2000 workshop.

Partners were given the task to create the web pages that would represent their work on the *NatureShift* web site. Only 10 percent of partners knew anything about creating web pages. They had not retained lessons in how to capture images and most had not learned to use photo manipulation software. They were not promised any training in technology but a voluntary technology lab

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[2] International Society for Technology in Education

[3] National Council for Accreditation of Teacher Education

[4] *NatureShift Exploration Model* - A four-part teaching and learning model that includes: 1. An engagement in the form of an authentic task, 2. A Web Adventure (research on-line), 3. A Real-World Adventure (explore learning in one's own world, and 4. A Project (multimedia-based summative presentation that captures the learning by the learner).

[5] Compiled data from *NS* Summer Institute and Winter Workshop "Exit Questionnaires," 1998-2000.

was put at their disposal for practicing any of the technologies they wished to learn. Ninety percent of workshop participants availed themselves of the technology lab. Evaluation comments at the close of the workshop revealed nearly 95% satisfaction with the workshop. Several evaluation comments clearly indicated educators felt they learned a great deal of technology as well as a new appreciation for web based instruction. Yet, no targeted technology training had been used during the workshop! Participant knowledge of technology was addressed on an individual basis during production.

The positive results of the Winter Workshop provided insight in designing the weeklong Summer Institute of July, 2000. Although not yet tabulated, cursory results from the Institute clearly indicate that using project-based instruction is much better at overcoming the technology learning curve than drilling in skills or putting technology in an educator's face and hoping they will overcome their preconceptions about it. At the Institute, partners were asked to design a *NatureShift* Exploration that would meet a curriculum need in their classroom. They were told their Exploration would have to be evaluated and would go up on the *NatureShift* web site. Again, there was no focus on learning technology, although new technology instruction was offered in audio production, video production, Inspiration software, and digital cameras. Teachers had to use cameras to record events at the Institute. They had to use Inspiration to present their curriculum concept, and they had to learn how to work in a networked environment on the computer. They were given plenty of time to work on their tasks. The results were more stunning. When partners returned home, they remembered how to logon to the *NS* server and transfer files. They complained when they did not have the latest technology because they already had plans for its use. Half of the partners had begun and even finished their *NS* project the following fall before staff had inquired into their progress. The basis of the *NatureShift* model is to build critical thinking and engage learners in problem-solving and inquiry-learning. It outlines a method for teaching that, when used for professional development has begun to prove its worth. The true test came when partners were asked to present their *NS* work and the ways they had found the project to be helpful. Presentations ranged from Powerpoint to posterboard. In each case, a clear confidence and appreciation of technology was evident. Projects reflected the clear value and place that technology would hold in their lifelong learning

Evaluation Methods The sources of data for this study include evaluations completed by partners, outside workshop participants, and pre-service teacher candidates enrolled in the *NatureShift* elementary education technology course at the University of North Dakota. Except for outside workshop participants, teacher candidates and partners all completed post evaluations of each training session. In addition, anecdotal data was collected at every course. Evaluation and survey instruments have not been validated, but were created by the project internal evaluators and have been consistently applied during the life of the project. The project's external evaluators will conduct statistical analysis of the data. Each pilot site educator is currently required to create a complete *NatureShift* Exploration, including all pedagogical stages of the model. During the final year of the project, educators will be required to conduct an evaluated test of their *NatureShift* Exploration in one of their classes or with selected students. The Exploration model requires students to process what they have learned and thought in a summative project. The student projects from an educator's Exploration will be evaluated for evidence of knowledge acquired and critical thinking. Evaluations will consist of a teacher assessment rubric, student assessment rubric and evaluator assessment of project content. The external evaluation team will provide the rubrics. The team will also evaluate student projects for evidence of critical thinking and knowledge acquisition. If partner educators have acquired skills with technology and grasped an understanding of how students learn by using different technologies, their Exploration projects will reveal the clearest evidence of that knowledge.

Summary

The myths of technology create strong impediments to understanding it. What are some of the typical myths that crop up and blur our vision? "Technology is fun! Students will be engaged just because we use it. Technology IS the curriculum. Technology is too difficult to learn. Technology is easy. Creative planning for technology takes a long time. Technology makes teaching better, more productive. Technology always breaks down." (*NatureShift* Project, Annual Reports of Progress). In some instances any one of these myths might be true. Yet it is the resulting attitude that colors our approach to learning. What *NatureShift* discovered is that educators come to a workshop with their myths embedded deeply to remain even after training has taught them differently. The most effective method the project has found to overcome the mountain of resistance or misconception is to remove the mountain from view. Give the learner the task of putting one foot in front of the other and the mountain is easily crossed because attention is diverted to territory that is understood. Give teachers an instructional task and they will learn technology like they learned to write on the blackboard, without little thought of the chalk in their hand.

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Usability Test of the PIC Website

Introduction

Over the past ten years, the field of education has experienced an incredible shift in focus in regards to the way information is accessed by and presented to both teachers and students. Computers in classrooms, educational software, and the Internet have become popular choices as educational and reference tools both for educators and students rather than simply diversions. Digital libraries, virtual museums, and the concept of "distance learning" continue to evolve as educational resources, fueled by demand from educators and students as well as policy makers. While these advances have greatly increased the number of resources available to users, much work remains to be done as to the effectiveness of these resources when used in a "live" environment.

The Plant Information Center (PIC) discussed in this paper is a web-based learning center that references a digital repository of botanical specimens (images) and botany-related information. As an educational tool, PIC extends beyond the boundaries of a traditional library through a series of applications that support interactive learning, communication with botanical experts, and a channel for contributing resources and knowledge to PIC's information store.

PIC is a partnership of the North Carolina Botanical Garden, the University of North Carolina (UNC) Herbarium, the UNC School of Information and Library Science (SILS), the McDougle Middle School, and the Orange County Public Library of North Carolina. PIC is a web-based educational initiative that provides integrated mechanisms for botanical study by unifying numerous resources and permitting access from multiple entry points. The goal of this interface is to provide a useful and meaningful tool for teachers and students in regard to the North Carolina Science Curriculum (Greenberg 2001). (http://www.dpi.state.nc.us/curriculum/science/strands_68.htm). This paper focuses on a study of the top-level navigation as it relates to overall usability of the Plant Identification Center's (PIC) website (http://www.ibiblio.org/pic) for middle school students. In particular, this study has aided in determining whether or not the design of the site provides intuitive access for the user to the site's tools.

Background

While there has been substantial research involving children's learning processes (most notably Piaget and Inhelder 1969), it was not until the 1990s that research was done on the specific information needs of children, or how they access this information (Hirsch 1998; Large, Beheshti, Moukdad 1998; and Fidel et al 1999). Studies regarding children's information needs, most recently Large & Beheshti (1999) shed light on the issue of how new technology either enhances information-seeking behavior or detracts from it (Large & Beheshti 1999). Other studies, less recent but equally important, by Carol Collier Kuhlthau (1988), V.A.Walter (1994), M. Gross (1995), and P. Solomon (1993) address the types of information needs of children. Most of this research deals with how children determine the relevance of information obtained through an electronic medium when faced with an imposed query; it also deals with their searching patterns (browsing) in respect to the Internet as a whole, not necessarily within an individual site.

Additional studies by C.L Barry (1994), J.S. Watson (1998), and C. Cool (1997) address the ways that students determine the relevance of information and the medium in which it is presented (text vs. digital). Finally and most extensively, much research has been done on the searching patterns of children (S.G. Hirsh, 1996; Schacter, Chung, G.K.W.K., & Dorr, 1998; Marchionini, 1989, 1995; Borgman, Hirsh, Walker, Gallagher, 1995; Large, Beheshti, Breuleux, 1998; and Bilal, 1999). Most of the recent work has focused primarily on electronically based information.

There has also been research done to determine the effective information architecture with regard to website usability (Gullikson, Blades, Bragdon, McKibbon, Sparling, Toms 1999). This research concluded that navigational aids play a crucial role in the effectiveness of a website, and emphasized the significance of these tools in users' overall satisfaction with the site. The research validates design conventions (Yale Style Manual, Web Developers' Virtual Library) that suggest an effectively designed website balances the number of initial options a user has and the depth of the site itself. An informal standard of two mouse-clicks to reach the desired information or goal is regarded as optimal from system design. Formally, the practice of studying and improving usability rests on using measurable data to gauge interfaces along several core points. Furthermore, usability literature encourages involving users in the design process and promotes an iterative design process that allows the product to evolve through early testing on real users (Nielsen 1999, Beyer & Holzblatt 1997).

There are several methods of assessing and improving the usability of an interface. In this project, we first performed a heuristic evaluation of the site. Using guidelines and heuristics from the Yale Style Manual and from Jacob Nielsen, we critiqued the site and identified possible problem areas. We then developed a formal usability test in order to measure our hypothesis against specific criteria on subjects from the target audience.

Interface description

The PIC website provides access to a variety of information sources, some of them advanced and complex botany tools; the structure of PIC is also rather complex. This interface was designed for use by middle school students, ranging in age from 11-15 years, for use in the science classroom. There are six main sections or tools available at the PIC website, as follows: Tree Identification Keys ("Plant Keys"), NC Trees, Plant Search (access into BOTNET database), Glossary, Frequently Asked Questions ("Ask the Expert"), and Links (to external relevant sites). These six main pages, along with the home page, compose the top-level structure of the site. These main pages share the same graphic layout and links to each appear in navigation bars (both along the top of the page and in the side bar) on each of the other main pages, with one exception. The Search page looks different, and although this page may be accessed from any other main page within PIC, it provides direct access only to the PIC home page. Some of these main pages, such as NC Trees, Ask an Expert and the Glossary, lead users to tools that are clearly within the framework of PIC. Other tools, such as the Tree Identification Keys and the Plant Search, lead to external resources. Furthermore, several of these sections (Glossary and Plant Keys) have several subsections included within them. These issues will be discussed further in later sections.

Critique of Existing Site

The PIC site presents an enormous amount of information as well as some sophisticated research tools , such as the BOTNET database. Especially for novice users, the site's organization and navigational aids will be fundamental to its successful and satisfying use. The PIC homepage provides explanations of each tool, as well as several links to each (a top navigation bar, a side navigation bar, as well as textual links in the descriptions). It is easy to get to any of the tools from the homepage. Also, the descriptions presented on this page are aimed at students in tone and language.

We identified the following points as possible breakdowns in the functional design of the site:

- Within particular tools, the site fails to give users a cue as to where they are in the site and how to easily return to the homepage or to another tool.
- Although offering quality information, the site's vocabulary within tools may be too difficult for more inexperienced botanists and students.
- The site lacks "graphic identity." The continuity of PIC breaks down once a user enters any of the specific tools.
- There are several areas, specifically the Dictionary and the BOTNET search results page, that fail to chunk information well.

Overall, the PIC site has some strong points; the homepage is designed with the student audience in mind and provides good cues for navigation. However, this careful attention to the site's audience falls away within the individual tools. These tools were originally designed for professional botanists, and younger students or novice users may have trouble navigating through them.

Usability Test Methodology

The test group consisted of eight students from a botany "cluster" at MacDougle Middle School, five males and three females. All students were 11-12 years of age. One student was in the sixth grade, the rest were seventh graders. All of the seventh graders had received basic classroom instruction in botany prior to participating in the study.

Specifically, this usability test sought to answer three questions pertaining to top-level navigation of the PIC website, as follows:

1. Can users identify the correct tool to use for a given task?
2. How efficiently can users locate information within a tool to correctly answer the given question?
3. Can users find and interpret the site's information to correctly answer the given question?

Students participating in this study had previously collected, pressed, mounted, identified, and researched a plant specimen using traditional methods. Students used the tools available on the PIC web site to validate their research regarding identification of the specimens. This usability test focused on how well test subjects completed twelve benchmark tasks associated with the system categories and the functions present in each. Two questions (or tasks) were assigned that related to each of the six categories of the PIC interface.

A 100% success rate in completion of these 12 tasks would have been ideal; however, a more realistic standard of success was based on a percentage of success relative to a passing grade in the science class (>68%). An effectiveness criterion was gauged by counting the number of mouse-clicks each task requires. While users may have taken different paths to access a particular tool, the efficiency of site navigation was determined by comparing the mouse-clicks used to reach a

particular tool with the shortest possible path. Additionally, each user was encouraged to "think aloud" while performing each task in order to illuminate the rationale behind each of the user's decision.

Volunteers were recruited and trained to act as proctors during the test so that each individual test subject would be paired with a proctor. On the day of the test, each proctor was provided with: one pre-test survey, one post-test survey, one task worksheet, a tape recorder with tape, a pencil for the test subject, paper and pen for proctor notes. Proctors set up testing stations at terminals around the computer lab.

When the test subjects arrived they were paired with proctors. Test subjects were reminded that the purpose of the study was to gauge the usability of the PIC website rather than the individual subject's personal competency in completing the given tasks. At this time, test subjects had in their possession plant specimens used in conjunction with the task worksheet.

Subjects first completed the pre-test survey. Subjects were then allowed five minutes to read over the PIC homepage and browse the site. At the end of these five minutes, the proctor started the tape recorder and asked the subject to begin working on the task worksheet. Subjects were allowed forty minutes to complete the task worksheet.

As the subjects progressed through the given tasks, proctors encouraged the subjects to think aloud and recorded the number of mouse-clicks used to find an answer to each question on the task list. If a test subject became "lost" in the site and was unable to reorient him or herself, the proctor made a note of this situation and pointed the subject back to the PIC homepage. Likewise, if a subject made various attempts and was unable to find an answer to a particular question, the proctor made a note and asked the subject to move on to the next question. Test subjects were encouraged to find answers to the questions on the site rather than relying on prior knowledge. If a test subject knew the answer to a question already, the proctor encouraged the subject to find the place in the website where this information was documented.

When the test subject completed the task worksheet, the proctor stopped the tape recorder. The test subject then completed the post-test survey.

Results

For analysis, we coded each question as "answered correctly? (y/n)," "correct tool used? (y/n)," and "number of mouse-clicks." We used these data to answer our original three questions. We coded all unanswered questions as "no" in both the "answered correctly" and "correct tool used" field.

Can users identify the correct tool to use for a given task?

We used proctor notes as well as audiotapes to decide if test subjects had identified and reached the correct tool for each question.

% Questions for which Test Subject used Correct Tool (TS = test subject)

TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	Group
64	86	79	50	43	79	71	50	65

% Students that used correct tool for individual question (Q = question)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
75	75	75	75	63	63	63	88	75	63	63	63	25	50

According to our standard of success (>68%), only half of the test group was able to successfully identify and/or locate the correct tool for each question. The fact that test subjects were in many cases able to provide the correct answer to the question despite failing to use the correct tool may mean that subjects were relying on prior knowledge or that subjects were able to glean answers from other areas of the PIC site. Overall, our data shows that the tool's descriptions on the homepage and the navigation bar's cues do not offer enough information for middle school users to intuitively assess which tool they need. Subjects had a tendency to either browse from tool to tool or to repeatedly return to the tool they found most familiar or easy (commonly the NC Trees page).

How efficiently can users locate information within a tool to correctly answer the given question?

We used proctor notes to find the number of mouse-clicks used to answer each question. Proctors also noted when test subjects had to scroll down, although this information is not reflected in the table below.

Average Mouse-clicks per Question compared to shortest possible path:
(Q = question, A = average of group, SP = shortest path)

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	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
A	7	8	8	8	16	16	6	9	3	3	7	3	4	6
SP	3	3	3	3	5	5	2	2	2	2	2	1	2	2

It should be noted that question five, which scored an average of sixteen mouse-clicks, involved using the Keys tool. Use of this tool involves answering a series of questions on successive pages; therefore the shortest path through the Keys to an answer may involve anywhere from three so seven clicks. Question six involved NC Trees, which should have been accessed through a shortest path of only three clicks to any particular tree. It is somewhat unclear, from our data, whether test subjects had difficulty in initially identifying NC Trees as the correct tool to use, or whether the high average of mouse-clicks for this questions reflects the fact that test subjects needed to back out of the Keys tool screen by screen since there is no direct link back to the homepage from within the tool.

Also, some of the tools require quite a bit of scrolling in order to reach the desired information. For example, both the dictionary and the NC Trees tools present long, alphabetically organized lists; these two tools would benefit greatly from alphabetical links at the top, allowing the user to jump directly to the desired section.

Overall, the number of mouse-clicks used to answer each question was higher than we had hoped. Averages declined toward then end of the task list; this may indicate that users were becoming more familiar with the site as they progressed through the tasks. More likely, the lower averages at the test's end mean that only the more efficient users had time enough to reach the questions at the end of the test.

Can users find and interpret the site's information to correctly answer the given question?

We used completed task worksheets, as well as proctor notes and audiotapes, to decide whether or not the test subject had correctly answered each question.

% Questions answered correctly (TS = test subject)

TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	Group
71	93	79	57	79	93	86	93	81

According to our previously stated standard of >68% indicating success, all but one of our test subjects successfully completed the task list. As a whole, the test group averaged 81%.

% Subjects that answered individual question correctly (Q = question)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
88	88	88	75	100	88	88	100	88	88	75	75	38	50

There is a significant drop in correct answers toward the task list's end, probably because most of the test subjects ran out of time before completing the task list. For the most part, if a test subject answered a question, they answered it correctly. That is, we did not see many incorrect answers; instead we saw questions that had been skipped entirely, abandoned due to frustration or confusion, or simply not reached due to time constraints.

While all but one test subject was successful in answering the questions according to our >68% standard, we found it interesting that not a single test subject was able to answer all fourteen questions. Trial runs through the task list by a proctor who had no previous experience with the site took about twenty-five minutes; test subjects were given forty minutes to complete the task worksheet. This indicates to us that the benchmark tasks took far longer for the test subjects to complete than we had anticipated.

Summary and Recommendations

Overall, we found that while the test subjects were able to answer questions by using the site, they were not efficient in finding their answers or overly successful in identifying and locating the proper tool. The post-test survey posed open-ended questions to test subjects . The answers to Question 2, "What did you dislike most about the site?" offer some illuminating information, as follows:

- "It was not well put together in the sense that you had to 'guess' if you didn't know much about trees."
- "Not enough pictures. The terms should be explained a bit better when trying to identify a plant."
- "a little too much information"

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From these answers, it seems clear that the test subjects did not find the site intuitive overall. Audiotapes also reveal that many of the subjects struggled with vocabulary on the site and would have benefited either from more pictures, more explicit instructions, or more ready access to the glossary/dictionary.

Several subjects expressed confusion in reading results on the BOTNET Search page. There is quite a bit of information presented on this page, and although the page currently uses a table and different fonts to set apart various pieces of information, the overall effect is overwhelming especially for novice botanists since records appear to run together. The page could be presented in strips of alternating color to distinguish records (gray/white/gray/white for example). Also, there is a Search box on the homepage that acts as a shortcut to the BOTNET search; our users tended to interpret this box as a search function for the PIC site in general rather than the BOTNET database. This search box should be either removed from the homepage or labeled explicitly as a shortcut to the BOTNET tool.

The site provides many ways to access tools from the homepage, but it does not provide adequate navigational aids for returning to the homepage or for moving directly to another tool. For example, once inside the Plant Keys tool, it is necessary to "Back" through all of the questions answered in order to reach a place where other tools are accessible. Also, although the "Plant Information Center" graphic at the top left of each main page is a link to the homepage; this is not obvious enough to most users. The site would benefit greatly from a static navigation bar that appeared either at the top or on the left side of every screen. Furthermore, there should be a clear cue to the user indicating where they are in the site at any point. This could be accomplished through a breadcrumb trail at the top of each page listing the path that user took to get there (for example, "Home→ Glossary→ Dictionary" where each of these is a link to that section).

The site presents an enormous amount of information; sometimes information is repeated in multiple sections, which may result in confusion for the users. Specifically, we found six distinct glossaries/dictionaries on the site. There are three sections within the Glossary tool alone, none of which seem especially intuitive for novice botanists. The Student botanical dictionary is not comprehensive enough to be fully useful for students; also, the wording in these definitions does not seem very different from the wording in the full dictionary. The full dictionary is certainly comprehensive, but is difficult to navigate since it requires so much scrolling. The full dictionary would benefit greatly from a navigational bar of alphabet links at the top, with corresponding "back to top" links at the beginning of each letter section.

There are many areas of the site in which the wording or vocabulary is too complex for young or novice users. For example, once in the Plant Identification Keys tool, users need to know the definitions to botany terms in order to answer progress through the tool. Although there is a glossary included in this tool, we feel it would be especially useful for users if alternate text could be incorporated into these pages to provide "look-ahead" definitions. Also, although one of the aims of the designers was to familiarize students with using professional research tools, we feel that users in this age group would benefit from more explicit, simplified instructions as to how the tools work.

PIC has great potential to be a valuable and fun learning tool for young botanists. It is encouraging that students were able to find information in the site, despite often failing to identify the correct tool to use. Ultimately, though, we feel that if students become confused or frustrated in their search for information they are unlikely to return to the site in the future. This test revealed several aspects of the PIC interface that interfere with its success as an educational tool. These results on are being incorporated into the next iteration of design on the PIC website. We have illustrated here that usability testing offers a means of gathering measurable data to support principles of interface design and learning theory. By using as iterative design cycle to address the issues discovered in testing, PIC designers can improve the interface in order to benefit the students who will be using it. As digital libraries and electronic resources grow in popularity and pervasiveness the need for systematic usability testing and iterative design cycles also grows. Resources such as PIC have the potential to give students an educational experience that would be hard to replicate without the computer and the Internet, but in the end these tools are only truly valuable if students are able to interact with them in the intended way and master their use.

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Footpaths in the Stuff Swamp

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Abstract

In this paper we consider stigmergy (loosely, the effect of communication through the environment) in relation to the Internet, especially with regard to Web-based learning. We begin by examining ways in which stigmergy occurs on the Web, before going on to describe its use in the construction of our continually evolving system, CoFIND (Collaborative Filter In N Dimensions). CoFIND's purpose is to replace the role of a traditional teacher in structuring and selecting learning resources. It attempts to achieve this through a process of stigmergy and natural selection, leading to a degree of self-organisation brought about through the independent actions and interactions of its individual users. We discuss some of the issues raised and attempt to explain some of its success as well as account for its failings.

Stigmergy

Stigmergy is a word coined by Grassé to refer to systems such as those employed by termites when building mounds (Heylighen, 1999). Termites build mounds start by dropping mud randomly in a given area. The presence of a mud heap encourages other termites to drop their lumps of mud nearby, with larger mounds being more attractive than smaller ones. Adjacent mounds therefore tend to grow towards each other, so forming arch structures. Stigmergy plays a role in many self-organised systems. It explains the formation of ant-trails, for example. If an ant finds food, it leaves a trail of pheromones on its way back to the nest. When other ants encounter this trail, they are inclined to follow it. If they too find food, they too leave a trail of pheromones back to the nest. As more ants find food, so the scent grows stronger. Eventually the food runs out, no more ants leave a pheromone trail and the scent dissipates. The ant trail ceases to be. Stigmergy also plays a major role in human dealings. This can for example be seen in the spontaneous formation of footpaths in a forest, recessions caused by fluctuations in stock prices and the large crowds that gather round smaller crowds in a street (an effect well utilised by professional buskers). A number of simple individual acts which affect the environment in turn affect other people, directly or indirectly. Coordinated behaviour arises as a result of indirect communication processes.

Stigmergy and the search for useful Web pages

The Web is composed of a vast number of individuals interacting with Web sites and each other. Much of this interaction is recorded, which suggests the possibility that something akin to footpaths in a forest could form, although many of those records tend to be hidden in individual server logs. Crawford characterises the Web not as a super-highway but as " a swamp, albeit a swamp with many remarkable hillocks of well-organized, first-rate data and information." (Crawford, 1999). If some sense or pattern could be discerned within the stuff swamp, a system of footpaths leading to useful hillocks, then navigating the Web would be a simpler affair. There are two clear potential approaches to the building of such footpaths: by design, or by stigmergy.

Footpaths by design

Yahoo represents the pinnacle of achievement in the creation of footpaths by design. Its large group of researchers trawls through thousands of web sites every day, weeding out the poor and ill-conceived, categorising and organising the gems that they find. Despite a bizarre classification scheme which puts *Education* next to

Entertainment, Arts and Humanities next to *Reference* which in turn sits next to *Regional* (Hudon, 2000), Yahoo's power is that it is organised by beings who understand meaning in a human context. This distinguishes it from the various web crawlers whose algorithms mechanically extract some kind of meaning from the content of what they are indexing. There are disadvantages with designing footpaths, a big one being that an individual's view or that of a small group will not necessarily coincide with that of the general population of users. Even where categories are agreed upon, unless the community of researchers has a similar set of interests and goals to those of the users of the system, relevance may be low. Because of this, a niche market has developed for more specialised directories or subject gateways, created by groups of like-minded researchers with an interest in a given field. Educational technologists might use The World Wide Web Virtual Library of Education (http://tecfa.unige.ch/info-edu-comp.html) or the TIP database (http://www.gwu.edu/~tip/) for example.

Footpaths by emergence

Recent generations of Web search engines, such as Clever (http://www.almaden.ibm.com/cs/k53/clever.html), Alta Vista's Raging (http://www.raging.com), and Google (http://www.google.com) make explicit use of "footprints" in the form of what Kleinberg (1999) describes at Latent Human Annotation. Such systems iteratively mine the Web for clusters, based on an analysis of in-degree and out-degree in hubs and authorities. Implicit recommendations based on what is effectively a form of citation (links imply approval) are condensed and purified, resulting in emergent patterns indicating popular and probably relevant sites of interest. A similar idea underlies the seminal PHOAKS (People Helping One Another Know Stuff, http://www.phoaks.com), which parses newsgroup messages for URLs, then bases its categorisations on topics and themes which relate to them. The quantity of citations in a relevant category provides the rating of a resource as useful or not.

Stigmergy is exploited by the family of systems generally referred to as recommender systems, collaborative filters or social filters. PHOAKS and Google are both examples of implicit recommender systems, which take a form of existing behaviour and extrapolate or infer preferences from what people are already doing. Amazon takes a similar approach when recommending books based on matching your purchases with those of others. The other main class of recommender system is the explicit variety, exemplified by Firefly (Resnick & Varian, 1997). Here, users are actively polled for their opinions on items such as films, books or Web sites, and their opinions are matched with those of other users to provide recommendations. By taking explicit recommendations, areas of uncertainty found in implicit systems are removed. In an implicit system, backlinks to Web sites may well be used in unexpected contexts which do not indicate a genuine recommendation, such as "this a dreadful site." Similarly, Amazon may often be used to purchase books as gifts and thus implicit recommendations might not reflect a person's own taste. However, if the user has explicitly rated a set of books then we can assume likes and dislikes with a high degree of confidence. The disadvantage of explicit recommendations is the demand that they make on users, leading to the cold-start phenomenon: if there are no ratings, the system is useless, as there will be nothing to match one user with the next. Early users will thus achieve disappointing results and (in a negative feedback reaction) will cease to use the system, which will therefore never grow. None-the-less, collaborative filters show interesting stigmergic patterns. Imagine a greatly simplified system with only two matched users. If user Adam recommends books A, B, C and D, Bob recommends books B, C, D and E, because their ratings intersect each will be recommended to read a book which they have not already read. Assuming that each likes the book that has been recommended, then they in turn will recommend them, leading to a stigmergic reaction. Without any intentional act of communication, an organised cluster will have developed.

Stigmergic communities

Community interactions, both synchronous and asynchronous, can provide some indication of the paths their users are taking. For example, it is easy to spot more popular newsgroups by the number of postings. Like crowds that gather around a busker in the street, the greater the size of the crowd the more likely it is that others will join it. More subtly, there are often clues which may be gleaned from the subject lines and hierarchical thread patterns themselves. For example, flames tend to follow recognisable patterns and word usage which will either lead others to read those threads or (perhaps more often) to avoid them. Similarly in Chat rooms, people tend to be drawn to areas where there is the highest activity. Once there, quantity of words is often a broad indicator of the quality of a given discussion. Short, social messages may indicate less depth than longer, involved messages. There is therefore a stigmergic form of self-organisation that inhabits even the least structured forms of

discussion. However, its operation is typically crude and undiscerning. Only the broadest of patterns may be visible and, as a form of self-organisation, it is no smarter than the rule which makes a group of birds nest together.

Enhancing stigmergy to structure communication

Stigmergy is exploited by a number of communication systems to achieve subtler and easier forms of organisation than would be achievable by their more primitive counterparts. A superb example of such a system is ChatCircles (Donath et al, 1999). In this system, each participant is represented by a circle. The more a person participates, the larger the circle grows, shrinking with time like the pheromone trails left by ants. It is only possible to "hear" people (see what it is that they are typing) by moving your own circle close to them. Thus, drawn by larger circles and larger groups, clusters of activity form naturally as a result of participation in the process. Two cues are available to the user, the size of the circles (indicating activity) and the number of circles in a cluster (indicating levels of participation and interest). Neither cue is the result of an explicit attempt to communicate with other users; they are simply the result of rational behaviours within the system.

Odigo (http://www.odigo.com) takes another approach, a synchronous chat system that centres discussions around web pages and web sites. Visitors to particular pages can discuss shared interests or the contents of those pages. Users can discover "What's Hot Now" identifying those pages that are most in use by Odigo users in real time. This feature enhances the users' ability to identify clusters and areas of interest. Popular sites draw more users, which makes them more popular and so the self-reinforcing circle continues. A related approach is taken by uTOK (http://www.utok.com), which allows asynchronous interactions through the ability to leave notes relating to a given site. As the user browses the web, the small uTOK panel indicates whether any messages relating to that site have been left by other users. The value of a site is indicated by the number of interactions, with users being drawn to sites with larger discussions. uTOK combines this with a voting mechanism for notes that have been left, which gives some indication of the quality of a discussion as well as the quantity of contributions. This multi-dimensional approach allows for richer forms of stigmergy than are afforded by, say, simple clustering alone. Through the application of simple local rules, complex patterns that convey sophisticated information to users of such systems evolve and develop. uTOK takes this evolutionary metaphor to its logical conclusion, as low-rated messages are removed from the system. Thus, both the structure and content of a given cluster of knowledge are determined by individual local interactions.

CoFIND

Over the past three years we have been developing a Web-based system known as CoFIND (Collaborative Filter In N Dimensions, first reported in Dron et al, 1999) which seeks to organise itself through the combined individual actions of its users. In essence, CoFIND is a self-organised database of resources, akin to a subject gateway, with a small, relevant body of resources created and found collaboratively by its users. It is written using Microsoft's ASP with a database backend.

CoFIND utilises evolution, in a Darwinian sense. Through a process of voting, resources (mostly Web sites) compete by moving up or down lists of returned results. The landscape on which they compete is variegated, with individual niches determined by the use of *qualities*, the things that users value in a resource. Typical qualities might be "useful," "amusing," or "good for beginners." A differently ordered list of resources would be returned by users seeking *useful* resources than by those seeking *amusing* resources. Like resources, qualities compete, changing size and moving up or down the list according to how frequently they are selected and how often they are used to vote for resources. If they are not much used, they will become "extinct". Users also decide upon binary categories for the resources, characterised in CoFIND as *topics*. As resources, topics and qualities are created by the users themselves; the system orders itself and is regulated according to the needs of its participants.

CoFIND is designed to be used by a single cohort of adult learners with similar learning goals starting at a similar state of knowledge. If there is too much disparity between the needs of the users, then whatever shapes and patterns emerge will be chaotic. As Darwin recognised, evolution and adaptation works most effectively in small, parcellated populations such as those found on islands. Large populations with high levels of connectivity result

in most significant changes and mutations being cancelled out by a process of dilution and competition. By limiting the participants to a small and focussed cohort, CoFIND results in highly focussed subject gateways.
The intention behind CoFIND is to create a kind of group intelligence that takes on some of the roles of a teacher. One of these roles is to select and recommend source material and texts for students to read, matched to the needs of those students. Through the use of qualities to rate resources and topics to categorise them, students are able to achieve this goal themselves, without central guidance. We have achieved a measure of success in this goal (Dron et al, 1999, Dron et al, 2000). However, a number of obstacles still remain, most notable of which are those of encouraging sufficient participation to overcome cold-start problems, and of achieving meaningfully self-organised results. Lately, we have been attempting to partially address these problems by developing CoFIND along more stigmergic lines, allowing richer patterns to develop than are possible through evolution alone.

Stigmergy and CoFIND

The first place we sought to introduce stigmergy was in the selection of topics, a solution that arose as a result identifying the wickedness of the problem of generating collaborative paths. We wished not only for users to be able to select appropriate resources for their learning needs, but (as a teacher would do) to select them in an appropriate order. However, the dependency of one topic on another, and the need to understand one resource before embarking on the next is an intractable problem. In most teaching there is a narrative thrust. The appropriate order in which tasks should be attempted is dependent on what has come before and what comes after. It would not be appropriate to average-out, concatenate, or otherwise join sets of elements from one path with those of another, any more than it would make sense in most novels to jumble up the order of the chapters. The meaning of a set of resources is intimately connected to the order in which they appear. Our solution was not to create a single path by combining others, but to attempt to shape the route through a subject area in real time, to collaboratively beat out the path through the topics as we go.

Stigmergy and topics

Topics are generated by the users of a CoFIND system. They may be entered by any user into one of four distinct, but undifferentiated, screen areas. This number was decided on purely pragmatic grounds, calculated according to how many words could be squeezed onto one average 800x600 screen and the assumption that an appropriate number of topics in any sector would be around seven, which is approximately the number of items that can easily be assimilated at a glance (Miller, 1956). Within a given area, topics are in competition with each other. Every time a topic is selected, it gains emphasis by getting larger, whilst other topics in the same area get smaller. The algorithm is balanced so that this change is not too dramatic, allowing for a certain amount of stickiness before topics start to fade away.

Figure 1 shows a use of CoFIND within a traditionally taught classroom setting.

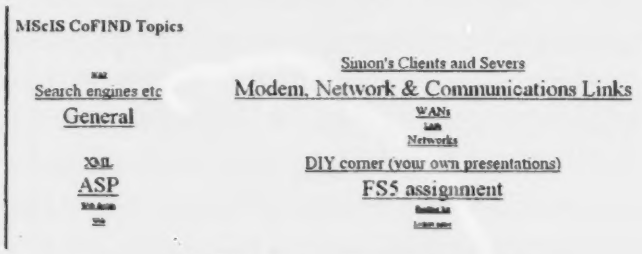

Figure 1: Simon's Clients and Severs

The prominent topics are mostly closely related to the development of the course at the time of this snapshot, with a project on ASP and a strong interest in XML in personal projects, for example. *Simon's Clients and Severs* [sic], however, is an anomaly. It was claimed to be a mistake by the student who added the topic, caused by a

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misunderstanding of how to add some of his own work to the system. In fact, this is probably untrue, because the student repeatedly clicked the topic label over a period of a few minutes immediately after adding it, thereby increasing its relative size and prominence. It is (even when spelt correctly) a topic of only marginal interest in the context of the course. Despite this, the topic got to be quite popular, visited by twelve different students over two months. This compares with only ten visitors over a similar period to *ASP*, a topic which was being covered in class and thus of greater intrinsic interest. It is thus tempting to conclude that usage was being driven by stigmergy, kick-started by the student who added the topic in the first place.

Stigmergy and qualities

The second explicit use of stigmergy in CoFIND lies in the quality selection mechanism. Like topics, quality labels vary in size according to usage. For a quality, the size of its label is related to the number of times it has been used to rate resources. In addition, qualities are displayed in an order which is determined by an algorithm which primarily considers the of number of times they are selected, tempered by the number of times they are used to rate resources, and a novelty rating which decays rapidly as they age. It is thus quite common in the early stages of quality evolution to find smaller labels closer to the top of the list than larger ones, as shown in figure 2.

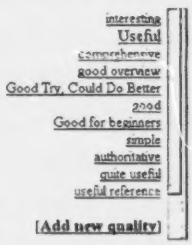

Figure 2: Stigmergy and qualities

Stigmergy in CoFIND is intended to enhance and emphasise patterns of behaviour. By providing different cues to the user, a more complex set of interactions can be elicited. The size of the quality indicates the relative number of explicitly rated resources which it will lead to, whilst position is an indicator of the relative perceived usefulness of the quality, gleaned largely from implicit usage statistics- users click the qualities which they believe will be more useful.

Users are encouraged to select a quality by its position and/or by its size. This process typically results in those qualities at the top of the list also having the largest labels as, once selected, a given quality will then be used to rate resources. The fact that this synchronisation does not occur straight away introduces a latency which magnifies the overall stigmergic effect, following a pattern like that of Senge's Beer Game (Senge, 1993). In the Beer Game, retailer, wholesaler and manufacturer are caught up in a vicious cycle of supply and demand which arises from the latencies within the system. Retailers, responding to a consistent slight increase in demand for a certain brand of beer, increase their orders from the wholesalers. The wholesalers increase orders from the brewer. Because of inherent latencies, partly due to delivery cycles and partly due to how long it takes to brew beer, orders are not immediately met, so everyone perceives increased demand and an inability to meet it. To compensate, the retailers increase orders to cope with the backlog, the wholesalers follow suit a little while later, the brewer brews more beer to cope. These effects are magnified as they rise through the system. By the time the backlogs of orders are met, all players in the system have a massive over-stocking of beer, orders are cancelled and everyone suffers accordingly. Within CoFIND, the analogous positive feedback loop is actually beneficial, leading to increased polarisation of the use of qualities, hence to a richer structure.

Discussion

The effect of stigmergy in CoFIND is used to create structure in a set of resources. By encouraging positive feedback loops, clustering occurs more readily than were the system simply to make use of qualities and ratings to decide which resources are valuable.

Our intention is to replace one role of the teacher with a collaborative group mind, a function that, by our own criteria, CoFIND is performing effectively. There is doubt, however, that this group mind can match that of even

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the dullest of professors. Whilst it is true that in every one of the ten or so instances of CoFIND so far implemented students at all levels have found and rated a set of resources far better than those already discovered by the teacher alone, there are problems with the ways in which structure has developed. The example of *Simon's Clients and Severs* is a good illustration of how the system may easily be subverted by a determined anarchist or self-publicist. It would be easy enough to programmatically prevent such an occurrence in future, but the fact that the ploy was successful shows that stigmergy can as easily lead to useless or even harmful categorisations as to those which have pedagogic benefits.

Another unresolved issue lies in the related problems of overcoming resistance to using the system and the cold-start phenomenon. The former problem is partly one of interface design, an issue that is slowly being dealt with. However, it is also related to the latter problem, as the system is only useful once there are many resources, topics, qualities and ratings. Although the use of qualities should help to more effectively discern useful resources, the overhead in providing ratings for more than one quality makes the start even colder than that experienced by most other collaborative filters.

CoFIND's problems are exacerbated by the fact that the system is currently only being tested within a conventional University teaching environment. This means that the students always have alternative sources of knowledge to CoFIND, that they are motivated by the need to pass examinations rather than to learn about a given topic, and that there is a limit to the time they can allocate to what is perceived as a fairly peripheral activity. It is significant that the most prolific use of the system so far has been when it is used to provide formative peer assessment of the students' own web pages. Like any computer system, it does not exist in isolation and, as an adjunct to existing working systems, offers insufficient extra value to encourage widespread successful use.

In conclusion

We have begun to show the potential for stigmergic systems in structuring a web-based learning environment and identified some techniques for providing richness in that structure. Although we have identified some fruitful directions, the potential is still waiting to be fully exploited. Part of the reason for this lies in failure to consider the system as a whole, partly in the inherent flaws in collaborative filtering technologies. It is, however, apparent that the Web gives enormous potential for the development of group minds, composed of yet distinct from their constituent individuals and, given time and appropriate environments, that these minds may one day rival those of traditional teachers as a means of creating, distilling, structuring and disseminating knowledge.

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Student and teacher collaboration in the Virtual High School

Bruce Droste, Virtual High School, USA ; Augusta MacAusland, Marlboro Graduate Center & Virtual High School, USA ; Ruth Adams, Shrewsbury High School, USA

The Virtual High School (VHS) is a consortium of high schools that offers network-based courses (NetCourses) taught by consortium teachers for students in consortium schools. Each school contributes at least one teacher, who teaches a VHS course in place of teaching a section of a regular course at school. Teachers in the VHS pool, with the help of experienced facilitators, design and offer NetCourses over the Internet. Each school in the cooperative can enroll 20 students in these NetCourses for each section of a teacher's time (i.e., one netcourse) that it contributes to the pool. Each VHS school also provides a part-time coordinator who acts as liaison among students, the VHS teachers, and the central VHS administrative staff.

In September 1997 the Virtual High School offered Internet-based courses for the first time to about 500 students in 27 schools in 10 states. In May 2001, after eight semesters of operation, VHS offered over 150 different courses to over 3,000 students in 300 schools located in 32 states and 12 foreign countries. The number of students enrolled and the average number of students per netcourse have been steadily increasing.

Statistics show that over 80% of the schools participating in VHS have enrollments of fewer than 1,500 students. Half of these schools have fewer than 800 students. As VHS has developed, some of these small schools have come up with creative ways to get involved in VHS, and VHS has supported them in order to make their participation possible. In some cases whole districts and geographic regions have organized into "sub-cooperatives," pooling their local resources to take advantage of VHS courses. For instance, four very small schools decided to join together to support the training of one teacher who will offer one VHS NetCourse next year. According to the reciprocal VHS formula, they will then distribute the 20 available student seats in VHS among the four schools. The bottom line is that instead of schools finding an expensive solution, or no solution at all, to the challenges that many schools face in meeting the demands for course offerings, they are able to work with VHS to develop creative solutions – all without hiring new staff or adding a new building.

To supplement its ongoing evaluation based on surveys and site visits, VHS in 1999 commissioned its third-party evaluator SRI International to collect data on the quality of a sample of the courses that were taught during the first two years of VHS's operations. (School principals and others at participating VHS schools had already reported that they believed the courses to be of high quality.) SRI convened a panel of six content area experts (which, as a group, had extensive secondary-level teaching experience, as well as state and national experience in the development and application of standards for curriculum, instruction, and assessment) to assist in establishing standards for NetCourses and to conduct course reviews. SRI collected 24 reviews for the 12 courses (2 reviews for each course) and synthesized the results. The study concluded that VHS courses provide students with high-quality curriculum content. The experts rated 11 of 12 courses at least "satisfactory" and more than half of the courses reviewed was rated as "high quality." The reviewers rated the area of curriculum content especially high for the large majority of the courses reviewed. These findings indicate that VHS's emphasis on multiple, interweaving quality control mechanisms is paying of and that students are being offered courses whose content is of high quality.

Vermont Governor Howard Dean: This is a model for what all high schools .. .. ought to be doing, especially small schools. Leland and Gray now has an opportunity to have a curriculum as good as any high school in the state, and the very best high schools anywhere in the country. This is a school of 240 kids and they don't have to take a back seat to any other high school in the country no matter what their resources are, This is an extraordinary project.

For additional information about the Virtual High School, including its current course offerings, visit the VHS web site at http://vhs.concord.org.

Portraying the Evolution of a Web-based Nursing Course Through the Eyes of an Educational Technologist

Jill Ducey, The University of Kansas Medical Center, USA

Our Educational Technology staff at The University of Kansas Medical Center works in a partnership with faculty members and clinicians to administer their classes on the Internet as web enhanced or as web based courses. Some faculty resist utilizing the Internet to teach a course. The purpose of our department is to curtail some of the reluctance they may feel about teaching a course online. An optimal faculty-technologist relationship can combine to create an intuitive web based learning environment. Depicted in my poster session is the first online course that my client and I developed. In the beginning my client had little experience with computer technology but was open to new possibilities. The first year the course had fifteen total modules, eleven taught in a traditional classroom and four taught online. The following year the course was taught entirely online. Over the last four years the course has seen the addition of a new discussion board, a task based icon system, and an orientation video. This poster session will illustrate the collaborative teamwork that morphed a traditional course into a cutting edge web based course.

NEW TRENDS IN WEB COMMUNICATION TECHNOLOGY: WEBCASTING

This paper examines a brief but rich history of Internet webcasting first born as a "push" technology that did not succeed. Later, webcasting was reborn as a phoenix in the flame of streaming video and audio. Now, it develops practical applications that are of interest for both individual and corporate consumers.

An archeologist of the Internet will find that most of the sites related to webcasting are dated 1997-98. Webcasting appeared in 1997 as the automated delivery of personalized and up-to-date information. Those were the glorious days of the Internet. The World Wide Web broke into the Internet mainstream just two years earlier and immediately brought the issue of information overload. The browser's technique of information retrieval demonstrated serious weaknesses from the very beginning. The Internet could be compared with the Library of Congress, with all the books scattered and visitors walking around and painfully trying to find a page with the information they needed. That's why after two years of the WWW experience, an idea came to apply the TV programming and broadcasting model to the Internet.

"Push" technology represented the first wave of webcasting and *Newsweek* advertised it as a fundamental innovation that would alter the fate of the Internet. This was a new model of delivery of information across the WWW designed for the individual customers as well as corporate users. While the previous model was based on "pulling" the information from the Internet, the new one promised to "push," or to deliver condensed and processed information directly to the user's desktop via pre-selected channels. "Push" technology had enough public exposure and venture capital but survived only in corporate intranets. Facing the dilemma whether to search the WWW or to search hard drives overloaded with pushed content, consumers decided to stay with the old browser technology of retrieving information. The

prophets of "push" technology also made a mistake by tying up their fates with the advent of the broadband Internet connection era. When it did not arrive on schedule, the credibility of "push" technology was seriously undermined.

In 1999-2000, webcasting was reborn in the streaming video and audio technology. Streaming implies real-time transmission of encoded video and audio over the Internet to multiple recipients. Instead of promising again an overnight revolution in WWW technology, webcasting is now focusing on practical issues that can be solved under the existing condition of modem ISP. DSL, cable modems, satellites, wireless technology, and bandwidth connection are the options under development. Webcasting insistently tries to return the consumer's trust by promoting real life projects. One of them is to bring local TV programming via webcasting to small rural and underserved communities. Webcasting is also used to promote public safety and security purposes. Another direction is radio broadcasting which is extremely successful. Further, webcasting is used for internal corporate tasks. Finally, new webcasting software and hardware is aggressively developed.

The "push" technology has been a battlefield between major players. Currently, we are witnessing a new approach where major players are united and cooperate within International Webcasting Association. Webcasting has survived in an attempt to become a viable alternative to cable and satellite television providers. After the days of the WWW "gold rush," a slow but steady time of meticulous explorations and work has begun.

Brewing ALE's: Creating Authentic Learning Environments

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Abstract: Making education more authentic is an important issue, and we believe the Internet can play a vital role in this aim. In this paper, we outline our research into developing Authentic Learning Environments (ALE's). We use our three level model of authentic learning to describe our practical investigations into this area in a university setting. We also highlight what we consider to be important design challenges for the future development of ALE's.

Introduction

The Internet and World Wide Web are playing an increasingly important role in higher education. Students now often ask "are your lecture notes available on the web?" The course website has become an integral part of the educational landscape for many courses. However, the World Wide Web has the potential to be much more than a passive information delivery system. In a previous publication (Eales & Byrd 1997), we argued that the Internet and the WWW could provide the opportunity for students to metaphorically break out of the classroom and to virtually deschool society. Our vehicle for virtually deschooling is the Authentic Learning Environment (ALE). An authentic learning environment seeks to support authentic learning by utilising a networked technical system allied to appropriate authentic learning activities. Our previous paper was largely theoretical, although we did offer a number of tentative design suggestions for systems to support authentic learning. One of the few perks of being involved in education is that it is possible to conduct educational "experiments" using our own courses and students. In this paper, we report on our practical attempts to create an authentic learning environment. Our experiments, not surprisingly, produced a wealth of interesting findings in a number of different areas. In this paper we focus specifically on the issues relating to authentic learning. We begin our discussion by outlining our original argument and attempting to further define and explain authentic learning.

Virtually Deschooling Society

At WebNet '97 in Toronto, Canada, we presented a paper entitled "*Virtually Deschooling Society: Authentic collaborative learning via the Internet*". In this paper we argued that technology had made little impact on educational practices in the past, but that the Internet had the potential to offer something very different. It could allow the student to break out of the classroom and the possibility of virtually deschooling society. We drew on Illich's (1973) radical ideas on deschooling (learning without schools) and attempted to link them to more modern theories of situated learning and authentic activities. The notion of authentic learning is closely linked to social theories of learning, situated learning and the idea of communities of practice. A community of practice is "a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice" and "participation in the cultural practice in which any knowledge exists is an epistemological principle of learning" (p. 98) (Lave & Wenger 1991). Seely Brown, Collins and Duguid (1989) argue that much of what goes on in schools is inauthentic and suggest that we should focus more on authentic activities. Educational institutions are, of course, also communities of practice with their own authentic practices. The problem is that educational institutions achieve credibility only if their explicit practices are of value outside of the institution. Skills, abilities or knowledge that only have value or meaning within the walls of educational institutions are considered to be inauthentic and of little value. Resnick (1987) suggests that there are four broad characteristics of mental activity used outside of school that stand in marked contrast to mental activities developed in schools:

1. Individual cognition in school versus shared cognition outside school.
2. Pure mentation in school versus tool manipulation outside school.
3. Symbol manipulation in school versus contextualized reasoning outside school.
4. Generalized learning in school versus situation-specific competencies outside school.

As Illich (1973) warned, "education becomes unworldly and the world becomes non-educational" (p.31). This danger is the motivation for authentic learning environments.

Authenticity, in its broadest sense, is an extremely complex philosophical concept. We intend to adopt a working definition of authentic learning as the development of skills and understanding that has relevance and value outside of educational institutions and particularly in the workplace. In an educational context, we use the term authentic to refer to learning that, in some way, reaches outside of the school community and culture.

A Model of Authentic Learning

In order to get a better understanding of the various ways in which an ALE might support authentic learning we have developed a three level model (fig. 1). We felt that the term authentic learning was being used in a number of different ways. We wanted some way of distinguishing between the different forms of authentic learning and in particular focusing on what we term level III authenticity, engagement with authentic cultures.

Level I - *Engagement with authentic information.* One of the great values of the Internet, and in particular the World Wide Web, is that it brings the learner face to face (via a fairly standard interface) with an ever expanding universe of local and global digital information.

Level II - *Engagement with authentic tools and simulation.* Some aspects of the "real world" can never be experienced in a direct sense. Simulation can be of immense educational value in these cases. Authentic simulation for educational purposes has exploited a number of different media and focused on a wide range of skills (see Vanderbilt 1990).

Level III - *Engagement with authentic cultures*. This is the level which we believe is of major significance, particularly in terms of the potential educational contribution of the Internet. Our focus in this paper is on the role of the expert participant. Other roles for authentic contributors include that of the mentor (see O'Neill 1998).

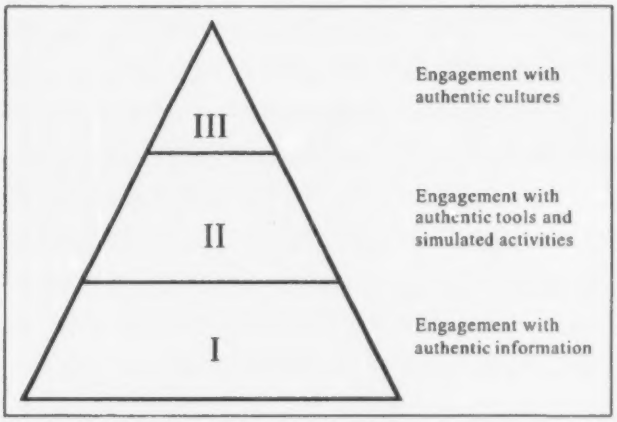

Figure 1: Three level model of authenticity

Investigation -The Context

The basis for our "experiments" was a third year undergraduate course module (class) in Computer Supported Cooperative Work (CSCW) in the department of Computer Science and Information Systems at the University of Luton, England. This module ran in 1999 and in 2000 and had 35 students on each occasion. The field of CSCW is concerned with the study of group activities and the design of computer-based technologies to support cooperative work (sometimes referred to as groupware). A particular problem in CSCW education, is that most students have limited or restricted previous experience of computer-mediated group activities. This is especially a problem at undergraduate level. Without this personal experience there is a danger that the learning will be overly theoretical and detached from the learner and most probably lacking in interest. As this CSCW module

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was essentially part of an Information Systems course our focus was mainly on the use of CSCW systems rather than their technical implementation, although we did consider some design issues. An important part of understanding CSCW is appreciating the subtleties of group activities and group dynamics mediated by technology (see Grudin 1994). Such issues as how do groups structure large collaborative information spaces, or how do individuals deal with event awareness in a constantly changing group workspace, require a large active workspace to provide a realistic experience. Complex computer-mediated social interaction issues are particularly hard for computing students to appreciate without first-hand experience. Our solution, which seemed appropriate, was to use a CSCW system to provide a hopefully authentic CSCW experience to underpin the teaching of CSCW theory. The use and development of the shared workspace became an integral part of the learning experience for this module

The basic course structure for a module consists of 2 hours per week for lectures and 2 hours per week for tutorials or practicals spread over one semester (approximately 14 weeks). The technical system described in this paper, was intended to replace the tutorial/practical element of the module. The lectures continued as usual. Assessment carried the following weighting: 50% final examination, 25% for a group assignment and 25% for participation in the collaborative workspace. One of the advantages of our particular situation was that the student's personal experience of the shared workspace was sufficient justification for using a CSCW system as part of the course. Having taken the decision to use the system it then seemed appropriate to seek to use it to investigate novel ways of supporting learning.

An important part of our investigation was the involvement of an authentic "expert". The expert was importantly not an academic but a practising researcher in CSCW, based at a major government research establishment in Australia. She was a representative of a culture of CSCW users and also of CSCW system developers.

The System

The software used was the Basic Support for Cooperative Work (BSCW) system (Bentley et al., 1997) developed at the German National IT Research Center (GMD) (http://bscw.gmd.de/). The software can be used for free on the servers at the GMD or can be downloaded for running on one's own server. BSCW is essentially an asynchronous shared workspace system. Access to a group workspace requires only a standard web browser. The system supports a variety of information-sharing activities including structured discussions, uploading and downloading of documents and links to websites. BSCW also incorporates authentication of group members, different access rights and event icons to indicate when objects have been added, changed, read etc. Participation in a BSCW workspace is restricted to registered members, and each registered user has a unique user name and password. The BSCW system was originally created as primarily a business tool but is being increasingly used for educational purposes (Appelt and Mambrey 1999). For us the system had a number of distinct advantages. It was easy to set up (we used the servers in Germany), it offered web-based access, was content-free, flexible and reasonably easy to use, in effect, an educational technology test bed.

Findings

One of the advantages of using a collaborative workspace system for these investigations is that all of the online interaction was captured in the workspace and was available for later analysis. Extracts (indented text) used in this paper are taken directly from the discussions in the shared workspaces. A short questionnaire was also administered to the student group at the beginning of the module

Level I Authenticity – Engagement with Authentic Information

The students were unfamiliar with the area of CSCW and had only limited experience of groupware systems. At level 1 we used the system to provide important online papers in the area and links to significant and interesting CSCW websites. This is very similar to a standard course website. BSCW, however, allows the students to actively participate in the collaborative development of this information space by adding links to websites they have discovered or by uploading relevant documents. The workspace was also useful for distributing course administrative information.

Level II Authenticity – Engagement with Authentic Tools and Simulated Activities

Our main use of the BSCW system was to support asynchronous threaded discussions about various issues in CSCW and to encourage the students to reflect on their use of the system. The educational value of asynchronous computer-mediated conferencing systems has been well documented (for example, Harasim 1990). We considered that these online discussions were not only educationally valuable but that they also simulated the kind of online discussions that might take place in a workplace. Such discussions have to have topics to fuel them. The main topics for our discussions were the BSCW system itself and the various social and technical issues that emerged during its use over time. As the sheer volume of information in the workspace increased various "secondary" phenomena occurred, such as the problem of workspace organisation, workspace event overload and group friction followed by the establishment of group norms. The students often expressed their frustration with these issues, but from an educational perspective these were valuable authentic CSCW experiences that are difficult to adequately describe theoretically and also difficult to simulate. For many of the students the shared workspace experience became more than just an educational activity, it developed into a genuine online community (Preece 2000) that stimulated their interest and motivated them to participate further.

At this level, the system was being used both as a simulator of workplace groupware use and as an experimental educational environment. These dual functions often lead to confusion, not least for the lecturer. What role should I play? I originally seeded various discussions but tried to stay in the background as much as possible. I later felt compelled to become more involved and play a more active part in trying to direct the learning. This is a "problem" perhaps peculiar to teaching CSCW, where the simulated authentic activity and the collaborative learning are so closely related. The system was also used to support small group (4 or 5 members) projects. Each small group created an online folder only accessible by group members. Some of the groups preferred to work offline and only submit their final report online while other groups took advantage of the system to exchange resources and versions of their reports. We would argue that the use of the shared workspace system proved very successful at level II of our model. The system supported educationally valuable and challenging activities while at the same providing first-hand experience of fundamental CSCW issues.

Schooling Bites Back!

Having tried to escape from schooling and to create a more authentic environment we found that schooling in the form of one of its most enduring myths "everything can be graded" blighted our activities. In previous course modules, where participation in a shared workspace was voluntary, student use had been somewhat limited. We decided from the outset that the extrinsic motivation of 25% of the final grade for participation was a necessary evil. Ideally we would hope that student reaction would be of this form:

> "Finally I think I would have contributed whether or not there was a grade involved, simply because it has been fun to use a new system like this!!"

However the more common student feedback was:

> "There is no way I would have participated in BSCW if there was no grade attached to it. I find it takes too long wading through all the various folders and discussions that are going on, by the time I finish doing that I don't feel like replying to anything. The sole reason for my participation is the GRADE."

I announced at the beginning of the course that there would be a grade for participation in the workspace and then rather naively hoped that the students would put the matter to the backs of their minds and just get on with participating. However, the issue of what constituted the right kind of participation was a recurring topic of discussion. Some students even virtually followed me around the workspace, reasoning that if they contributed to a discussion I had contributed to, their contribution would be sure to be noticed. Student behaviour at times resembled pigeons pecking at seed in a Skinner box.

Design Challenge – Authentic Assessment

Part of the student anxiety about assessment was no doubt caused by the fact that it was a new type of assessment for them. I wanted to motivate activity rather than simply assess some deliverable. I wanted to reward the quality of participation as well as quantity. Providing a set of clear marking criteria at the outset could have no doubt reduced the general level of student anxiety, but it does seem

to be inherently difficult to grade activities like participation in discussions. Assessment is possibly the most inauthentic practice in educational institutions. This is not to say however, that assessment does not take place in the workplace or in other areas of life. How can we assess in a more authentic way, or better still, how can we instil intrinsic motivation without assessment?

Level III Authenticity – Interaction with Authentic Culture

[Education] "cannot be a closed system that shelters a well-engineered but self-contained learning process. On the contrary, it must aim to offer dense connections to outside its setting" (p. 275).

Etienne Wenger (1998)

We considered the level III activities to be the most important and perhaps the most novel part of our educational experiment. The major advantage of creating an asynchronous educational online workspace with universal (web-based) access is that people can participate from anywhere in the world. The key ingredient at this level was the expert. We saw the expert as above all a representative of an authentic (CSCW) culture, a community of practice of users and of developers. In this capacity she could provide a valuable authentic correcting and modifying influence on the development of our culture represented in the shared workspace. There is a very real danger that in a university, Level I and II "authentic" learning will mutate into an inauthentic set of practices. At a more basic level our expert also played the role of the outsider, as she pointed out "In this situation, I'm really the only outsider". For the students there is no doubt that she also represented the exotic. For some strange reason young people in England are intrigued by anything Australian. The principal activity of the expert was to join in the various online discussions, most of them relating to CSCW. In particular, there was an "ask Kylie" folder that functioned rather like an asynchronous meeting room.

The observations and comments of the expert had a significant influence on the discussions and practices of the shared workspace. For example, acting on her suggestions, we set-up an introductions folder where everyone was encouraged to write a little bit about themselves and their background. We also started signing our comments in discussions rather than just relying on our somewhat obscure user names. Later influence in the workspace was somewhat overshadowed by an embodied visit from the expert.

Whose Culture is it, Anyway?

The impact of the "authentic" is a valuable resource. Our virtual expert had a significant influence on the activities and learning in the module. However, we would have liked to maximise or magnify her influence. One of the main problems seemed to be that she had to come to terms with our culture. In many ways the shared workspace became an extension of the module and of the university. The workspace existed only online, its physical location was actually in Germany, but the culture undoubtedly represented Luton. Our expert expressed confusion about various aspects of the workspace culture.

> "...yes, it is a bit strange participating in BSCW discussions from such a long way away. It's not so much the distance but because of the distance, I don't know the people who are contributing, nor how to interpret what I read."

I set up the workspace; many of the participants knew each other off line; membership was restricted to module members who were motivated by a good grade. Such factors tend to naturally influence the fundamental character or culture of the online community and make it difficult for an outsider to have an impact. It seems we had broken out of the classroom only to take the classroom with us.

Design Challenge - Virtual Legitimate Peripheral Participation

How can we maximise the level III impact of our expert without significantly increasing the amount of time and effort required from her. Clearly her influence was constrained by numerous factors including the activities of the workspace, her role, the influence of assessment and the existing bonds between members of the module. The expert also had to enter the shared workspace without her cultural trappings, her specialised language, her artefacts, her common knowledge and beliefs. Lave and Wenger (1991) described how newcomers became part of a community of practice as "legitimate peripheral participation". What we ideally need in an authentic learning environment is for the students to enter the culture of the expert rather than the expert to enter the culture of the students, a kind of virtual legitimate peripheral participation. We are not suggesting that this would be "true" legitimate peripheral participation, but we are suggesting that this could be a valuable and authentic educational

experience. One way of achieving this would be to give students restricted access to the shared workspace of a workplace. (The research centre where our expert was based also used the BSCW system on occasions.) In this situation the expert could become a guide or interpreter for the group. Perhaps students could even perform some useful function such as test subjects.

Conclusions

In this paper we have outlined our experiences and theories focused on the idea of developing authentic learning environments. We have only just begun, and there are many technical and educational problems to be solved. We are motivated however, by two powerful convictions. Learning should be more authentic and the Internet is potentially an extremely valuable tool for supporting authentic learning.

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Creating Successful Learning Environments Using a Web-enhanced One Computer Classroom

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Abstract: One computer classrooms have become the bain of numerous educators since the first computer was placed in the first classroom. Away from all the other computers, sitting quietly in the corner collecting dust. Yet the classroom environment is slowly changing and evolving to include ... a Web-enhanced one computer classroom. The Web-enhanced one computer classroom is a useful environment, once the seeds of disparity are overcome.

Introduction

Since Vannevar Bush (1945) first imagined the creation of an intelligent machine that could hold all of the knowledge in the world and the machine could learn from trying to duplicate a human's mental process in an artificial manner, man has been moving steadily towards the Information Age. With the rise of the World Wide Web's existence, and open access for use by the general public in the early 1990s, the information that is accessible by a computer has become insurmountable. Even as early as 1980, Seymour Papert suggested the existence of a simplistic computer that would offer easy access and learning opportunities to the learning environment.

> I believe that the computer presence will enable us to so modify the learning environment outside the classrooms that much if not all the knowledge schools presently try to teach with such pain and expense and such limited success will be learned, as the child learns to talk, painlessly, successfully, and without organized instruction. (Papert, 1980, p. 9)

With such prophesies as these, the technologies have led us towards the dawning of the new Information Age, where anything is possible. The one significant difference between the technology and its appropriate and successful use within a learning environment is the influence of the instructor; only the instructors has the subject matter expertise and the instructional design skills to appropriately and successfully integrate the technologies available today. After all, "Computers are not an end in themselves. The goal of technology integration into the classroom and curriculum is not to expose students to computers and the Internet. Technology, by definition, is a tool" (Dockterman, 1998, p. 21). Perhaps the most difficult aspect to help educators realize is that technology is just a tool, just as a pencil or paper or a chalkboard have been touted as revolutionizing elements within a classroom environment, so shall the computer. Yet a one computer classroom is the environment that many educators find themselves in these days, with Web access an element that must be further discussed.

Why the One Computer Classroom?

The drive to place computers in every single classroom has become a driving force over the previous eight year period. Numerous levels of the community heard the need and the desire for computers in the classroom and a push began to entrench the hardware in the schools to enhance the learning environment. The hardware is advancing by leaps and bounds, but what of the professional development opportunities that must follow the hardware? Educators must have the time and opportunity to delve into the numerous capabilities of a Web-enhanced computer that sits on their desk. There are so many possibilities for a one computer classroom that it is astounding. Yet three overriding themes concerning a one computer classroom have been designated.

What Can an Instructor Accomplish With Just One Computer?

A computer can help an educator accomplish numerous aspects of the professional day's events. One computer in a classroom environment can be a tool that not only enhances the educator's daily chores, but also enhances the learning environment. Dockterman (1998) offers at least four elements that are generated by the computer in the classroom educational environment.

- One computer for personal productivity
- One computer as a presentation tool
- One computer and interactive group software
- One computer as a learning station (Dockterman, 1998, p. 23)

The educator has the opportunity to enhance personal productivity of tasks such as student attendance and digital gradesheet software. Further, the educator has the ability to hook the computer up to a television set as a presentation tool, or load the computer with Web-enhanced interactive group software to enhance active learning environments that could also enhance the computer as a Web-enhanced learning station. Only the creativity and opportunity for professional development opportunities that enhance the educator's creativity will further the integration of technology within the learning environment. However, time must be set aside for the educator's specific professional development opportunities to encourage the integration of the technological endeavors into the curriculum; time is one element of which all educators find lacking and this must no longer be the situation if educators are to enhance not only their technological skills but also the learning environment for their students.

Conclusion

As with all innovative and creative possibilities, a risk must be taken in order to learn and improve upon the opportunities for the learning environment. After all, "The goal is to support an underlying educational purpose. And that underlying purpose and understanding will remain with the students regardless of what happens to the technology" (Dockterman, 1998, p. 22). Creating a successful learning environment is the focus of every professional educator, and all tools must be appropriately used towards the accomplishment of the lesson objectives. The use of a Web-enhanced one computer classroom is merely one way to reach these goals.

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Web Access@Fresno State: A Plan for Implementing Web Accessibility at California State University, Fresno

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The release of the Rehabilitation Act's section 508 standards for electronic and information technology in December 2000 has served as a catalyst for university Web accessibility efforts. At California State University, Fresno a work group was formed in November 2000 to lead its Web accessibility activities. The key question of the group was how to implement Web accessibility. Development of an implementation plan was seen as the core component necessary to guide the campus in its Web accessibility activities. The Draft Interim Web Accessibility Plan is an attempt to provide a comprehensive planning document that will guide Fresno State for the next two to three years. This poster presentation provides an overview of Fresno State's plan and planning process. The lessons learned from Fresno's experience will be presented along with the key planning questions that should be considered by university's developing an accessibility policy and plan.

Using Checklists for Large Scale Website Audits

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This paper describes the methodology for a comparative audit of 108 websites under the jurisdiction of an Australian State Government using a checklist to evaluate usability criteria. The objective of the review, conducted by Access Testing Centre (ATC), was to evaluate and compare the 108 websites against a variety of specified conformance and usability criteria, in order for the client to identify and promote best practice and uniformity.

To compare the websites against a range of usability criteria, ATC developed a unique testing instrument that took the form of a checklist, which identified key areas of strength and weakness in each site from a sample of key pages. It was developed using a seven-point rating scale incorporating a range of usability criteria drawn from conformance specified by the client, W3C guidelines and usability heuristics.

The main benefit of developing and implementing a checklist to evaluate the websites was the creation of an accurate method for analysing a large sample of websites while minimising the time usability experts spent on the task.

Employing Internet2 Technology to Enable Collaborative Research and Distributed Training in Complex Multi-Operation Settings

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Abstract: The United States Air Force is positioned to take full advantage of Internet2 technologies. This paper summarizes the Air Force's Distributed Mission Training Research Network (DMT-Rnet), an Internet2 based network for collaborative research and training via distributed PC-based systems. This network creates complex environments for multi-operator training and performance research. An initial phase of this project utilizes the dynamic distributed decision making network (DDDnet) as the platform. DDD simulations require important team-oriented cognitive processes such as communication and coordination, resource allocation and sharing, and decision making. Observers at each of the distributed locations rates performance using web-based tools that allow immediate data pooling, analysis, and feedback, within 10 minutes after data input was complete.

Introduction

The United States Air Force is positioned to take full advantage of Internet2 (I-2). Emerging capabilities from I-2 technologies are already enabling huge advancements in Internet-based training and performance-based research. Current Internet-based technologies have limitations that restrict progress such as severely limited bandwidth, reliability issues, latency, interruptions and security issues. These barriers can be minimized with I-2, due to much greater bandwidth and efficiency. This brings about new opportunities in collaborative research and training.

Just a cursory look at speeds alone is impressive. An OC-48 connection on one of the main backbones of I-2 runs at 2.4 gigabits per second, which is about 45,000 times faster than what people typically have to endure on a 56K modem. New options such as multicasting, tele-immersion, virtual laboratories, digital libraries, and distributed learning added to the mix create an Internet that can be used for much more than ever envisioned.

Here at the Information Systems Training Research Branch, Brooks AFB, researchers are involved in two major programs grounded in I-2 technology. One example of this is focused on investigations and enhancement of operational expert training through an internet-based research base to enhance Distributed Mission Training (DMT). The DMT-Rnet project will establish an I-2 based network for collaborative research and training via distributed PC-based systems. Another area of research that is growing exponentially is the Advanced Distributed Learning (ADL) project, an "umbrella" topic of research which integrates numerous multidiscipline projects. Both DMT and ADL projects are national in scope.

In this paper we describe the first phase of a DMT-Rnet collaborative research program in which we are leveraging emerging I-2 capabilities to connect distributed PC-based simulation systems and create complex environments for multi-operator training and performance research. The USAF DMT project relies on a network of highly realistic battle simulators that allow expert operators to train in a virtual battlespace across a highly secure and classified communication network. In contrast, the DMT-Rnet project will develop less expensive PC-based systems that can run in unclassified mode on Internet2. This allows the PCs to be distributed and deployed as training systems in almost any setting. It also allows University-based research to occur, using these simulation systems that reflect essential components of operator expertise. In fact, multiple Universities can and have been networked to enable real-time multidisciplinary collaborative research.

An initial phase of this project utilizes the dynamic distributed decision making (DDD) team-in-the-loop simulation environment (Hess, MacMillan, Elliott, & Schiflett, 1999; Kleinman and Serfaty 1989) as the first platform for this work. DDD simulations require important team-oriented cognitive processes such as communication and coordination, resource allocation and sharing, and decision making. Other systems have also been developed within this program, and each provides an integrated, internet-enabled, collaborative training space that supports three integrated capabilities: distributed team performance; distributed assessment; and distributed training (Elliott, Chaiken, Stoyen, Petrov, & Riddle, 2000; Schiflett & Elliott, 2000). For example, another internet-based platform based on AWACS WD functions is a java-based architecture composed of a federation of "intelligent" agents. These agents generate and execute scenario function, data collection, decision support, and can emulate WD roles within the scenario. That allows participants to play with or against agent-based simulated friendly and/or enemy forces. It can also execute scenarios in all-agent mode, providing what-if analyses of different scenario characterstics (e.g. amount, location of assets and targets).

For this particular effort, we developed an internet-based version of the DDD, the DDD Network (DDDnet), which allows players in distributed locations to connect and perform a distributed mission in real time. Preliminary tests of the DDDnet were successful. Participants from four Command and Control research groups (e.g. Brooks AFB, TX; U of South Florida, U of Central Florida, and Aptima HQ in Boston, MA) were connected and performed in a team-on-teams Command and Control battlespace scenario. The DDDnet achieved and maintained a synchronized connection involving all 16 participants. Simultaneously, observers at each location rated performance using web-based tools that allowed immediate data pooling, analysis, and feedback, within 10 minutes after data input was complete.

The DDDnet is a internet-ready version of a Linux-based collaborative gaming space that connects players to each other and to others, such as observers, confederates, trainers, or researchers. In the DDDnet observers at any location in the network are able to observe the scenario play in real time. They can view the screen display and electronic communications of any player, and communicate to one another via email or voice. In addition, the DDDnet can connect players to one another for interactive mission planning, debriefings and after-action reviews. Other internet-based systems have also been developed for specific training and research functions, within the scope of the DDD-Rnet project.

Researchers using these internet-based systems will be able to access detailed performance and team processes during the mission planning, mission execution, and during the mission debriefing phases of performance. An integral part of the DDD Rnet is a suite of team performance and process measures that provide feedback and evaluation metrics for team performance. These measures are available from three sources: the DDD simulation data output, observation-based input provided by distributed observers, and reports provided by the participants. They can be targeted at four levels: individual performance; team performance, and system-level team-on-team performance, and mission outcomes. The DDD-based performance measures focus on mission outcomes related to capture of effectiveness, timeliness, efficiency, speed, and latency of particular events embedded within a scenario. The DDD can collect and provide feedback on many of these measures in real time, throughout the performance of a scenario. Others are captured immediately afterward through web-based data collection and distribution systems.

Issues

DMT enables highly realistic mission rehearsal based on networks of high-fidelity simulations that immerse the personnel in virtual battlespace scenarios. These simulators are highly realistic, in terms of equipment characteristics and procedures used in an operational setting. They look and function just like the "real thing". In fact, some of these systems are fully functional as operating USAF systems—the main difference being the added capacity to connect and operate within a simulation network. Because these simulations strive for maximum

realism, they must run in classified mode within its own dedicated network, thus restricting data analysis and publication. Further, systems such as these are extremely expensive, difficult to deploy and utilize in field settings, and less available for use, relative to PC-based systems.

In contrast, DMT-Rnet systems will enable systematic investigations in unclassified mode and establish the infrastructure to conduct multi-level investigations of operational performance using less costly PC-based systems. These systems can be readily deployed to operational field settings and enable cost-effective distributed training wherever internet access is available.

DMT-Rnet systems will not be total replications of operational systems. Instead, these synthetic team task sytems will capture the cognitive and task demands of most interest to trainers and researchers (Elliott, Dalrymple, Regian., & Schiflett, 2001). For example, a PC-based system may simplify the "button pressing" procedures required in an actual operational system and instead focus on display characteristics, decision making processes, tactics, strategies, and/or teamwork functions. Convincing arguments have been stated for the relevance of systems which are based on psychological fidelity, and the absolute need for internal validity for the advancement of scientific knowledge (Berkowitz & Donnerstein, 1982; Cook & Campbell, 1979; Mook, 1983). The DDDnet was developed to represent the underlying cognitive and decision making task demands of Airborne Warning and Control System (AWACS) Weapons Director Teams, based on multiple investigations of cognitive and functional aspects of this performance domain (Coovert, et al., 1999).

Another benefit of this type of a synthetic task environment is the variety of subjects that can participate in the research. High fidelity simulators are so close to reality that they necessitate expert operators as subjects. There is a shortage of personnel in the Air Force in general, and particularly for high-expertise tactical operators. The operational Air Force simply can't spare these people for all of its research issues, regardless of potential payoff from these investigations. Systems such as the DDDnet can use naive subjects and train them quickly to use the system, thus allowing skill acquisition to focus on underlying tactics, strategies, teamwork, or other training/research objectives. This saves another commitment of operational personnel for the Air Force as well as money, both of which are in short supply. It also allows researchers to study knowledge-based skill acquisition processes and interventions (e.g., training content and delivery; distribution and display of information; coaching and decision support capabilities).

The issue of knowledge aquisition is important when working with training objectives that are remotely administered and scored, for example Advanced Distributed Learning (ADL). To achieve optimal content and delivery, we must use cognitive principles to identify specific knowledge structures required to coordinate, interpret, and predict the activities of others. This is fundamental to measure and enhance individual and team situational awareness. We must measure, from a functional cognitive perspective how often people should update their knowledge, by what method, how it should be shared in a team.

Performance feedback is another critical objective in this project. Targeted feedback is necessary for progress and quality of training. Distance training makes this a little more difficult, but with the right steps it can be accomplished. Here, we focus on embedded measure of awareness and performance, online feedback, web-based collection, and rapid delivery of performance feedback to facilitate debriefing. The same technologies that enable the DMT-Rnet missions can be used to provide performance feedback.

Method

The AWACS DDD-Net was recently implemented and demonstrated, allowing distributed simulations over the Internet. Aptima, a small research corporation, worked with faculty and staff at the University of Central Florida (and associated Institute for Simulation Technologies [UCF/IST]), the University of South Florida, and researchers located at Brooks Air Force Base to test the feasibility of the project (Entin, Serfaty, Elliott, & Schiflett, 2001). It linked the different locations, allowed multi-role missions, data collection, and feedback. Different parts of the network included Internet2 connections for improved speed and performance. At the same time, we investigated the manner by which the subjects shared and sequenced information and resources.

The network presented a prepared scenario, with objectives laid out. People in the different roles had individual taskings as well as an overall mission goal. The software presented them a map with their unit information displayed. They controlled the movement and action of the units assigned to them. Teammates shared the information regarding position and movement of relevant friendly and hostile forces. Resources were reallocated between teammates as necessary for optimization, or even between different site nodes of the network.

For example, someone connected at a node in the University of South Florida can send a message to the person playing the role of the Joint Forces Air Component Commander (JFACC) at a node at Brooks Air Force Base requesting control of a KC-135 (refueling tanker). The JFACC can then switch control of the KC-135 to his naval counterpart working from the University of South Florida.

Information was shared much like resources. An example is someone playing the role of Intelligence, Surveillance and Reconnaissance (ISR) operators. This person has control of various information gathering tools, such as Predators UAVs (Uninhabited Aerial Vehicles). They send out these Predators to find specific targets or locations. Once found, the ISR team sends this information to the appropriate person needing that information. It can be sent to everyone in his or her particular site, or to other individuals require that specific piece of information.

Communication and resource allocation within and between the different sites is closely monitored and analyzed, and will reap enormous amounts of useful information on command, control, and communications process measures.

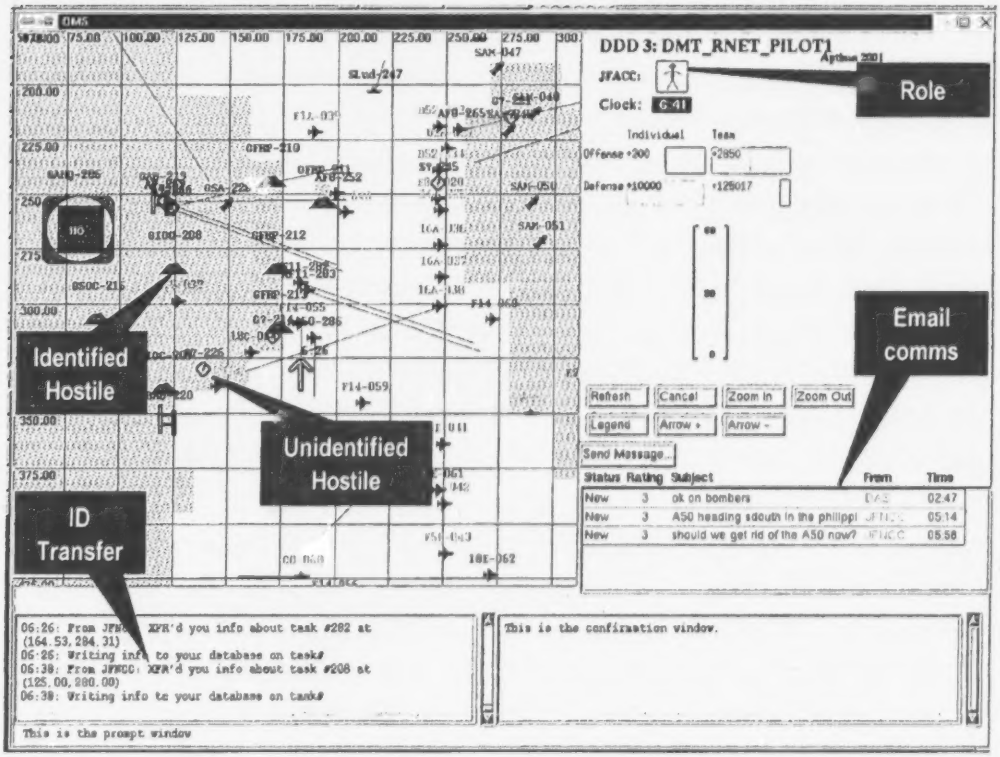

Figure 2. DMT-RNet Screen from distributed scenario execution involving four nodes

Summary

Brooks Air Force Base has teamed up with a small business (Aptima), the University of Central Florida, and the University of South Florida to create the DDDnet, a command and control training and research system using PC-based systems networked by a mixture of current Internet and I-2 connections. The DDDnet is a low physical fidelity system focusing on the cognitive tasks and decision making processes involved in command and control rather than realistic replication of operational weapon systems.

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The DDDnet will be part of the larger DMT-Rnet, which is envisioned as a research and training network that presents mission-type scenarios ranging in complexity from very simple to highly realistic battle scenarios which could challenge operational experts. Classified information is not involved, making it possible to utilize I-2 technology to maximize performance. DMT-Rnet systems trade off total realism to attain advantages of much lower cost, transportability, and features valued by trainers and researchers. These features include quick and easy scenario generation, online performance feedback, tutoring mechanisms, and the ability to manipulate, control and/or configure task demand, display characteristics, and other functional aspects of the system.

Multiple operators collaborate in the presented scenarios, and are given different levels of resources and information. They must work together, implementing the most efficient methods of sharing these resources to accomplish the mission. Assessment and feedback are integrated into the program. These platforms are analogues of actual operational systems, based on cognitive task analyses conducted during system development. They will enable distributed and multidiscipline research to present new information on individual, team, and system performance. They will also serve as cost-effective systems that can easily be deployed to any site having access to the internet. Results will benefit the Air Force specifically, and will also generalize to other similar performance domains requiring collaborative real time problem solving and crisis management teams.

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E-Learning at Southern Cross University: Past, Present and Future

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Abstract: This paper describes developments in the use of the World Wide Web and e-learning at Southern Cross University over the last 10 years. It then looks ahead at opportunities and challenges that are likely to be faced during the next 10 years.

Southern Cross University was an early adopter of the World Wide Web having a server up in 1992 and a University Home Page in early 1993. While limited use of student email groups had occurred prior to the Web it was the Web's point-and-click and graphic capabilities that really launched the current phase of interest in e-learning.

Between 1995 and 1997 there was limited experimentation with individual, Web-based units and Web-mounted course resources. In 1998 special funding provided by the University Executive allowed for full design and development of sufficient units to support the commencement of online delivery of two degree programs. In addition, the online course management software/hardware solution LearningSpace was adopted. Unfortunately it proved unsuitable for the Southern Cross University environment and was replaced by Blackboard CourseInfo that was phased in during 2000.

In 2001 and beyond the University faces a wide ranging series of challenges and opportunities, many of which will have to be successfully addressed if the overall development of e-learning is to be consolidated and become a sustainable, mainstream University activity.

Early Technical Developments and Explorations (1992-1994)

The early technical development and rapid technical evolution of the World Wide Web (the Web) is well documented in books by both the co-developers Tim Burners-Lee and Robert Cailliau (Burners-Lee (1999), and Gillies & Cailliau (2000)). Up until the end of 1993 the use of the Web was largely confined to the global high energy physics community where it was used for the exchange of documents related to collaborative projects. In addition to these engineers and physicists some university computer department staff and a few developers were also experimenting with the Web. Towards the end of 1993 there were still only a few hundred servers worldwide and Web (Port 80 http) traffic measured only around 1% of the NSF backbone traffic (Connolly, 2000).

Southern Cross University (SCU) was an early adopter of Web technology with a trial Web server being downloaded from CERN and operating in the Computing Centre in late 1992. This Web server was the second in Australia and within the first 100 to be set up globally (Hill, 2000).

In 1993 the Web was demonstrated at a number of SCU seminars and its potential to displace an existing gopher-based campus wide information system was discussed. Furthermore the possibility that the Web could function as an innovative educational technology was also recognised by some staff. The release of the Mosaic browser for all common platforms in late 1993 made the Web even more attractive than it had been when only line mode text browsers had been available.

In May 1994 the Web moved into the wider community with the heavily oversubscribed First International World Wide Web conference organised by Robert Cailliau and held at CERN research facilities in Geneva (http://www94.web.cern.ch/WWW94/). This ground breaking conference was followed in October by a second conference, aptly titled "Mosiac and the Web", held in Chicago and organised by NCSA

(http://archive.ncsa.uiuc.edu/SDG/IT94/IT94Info.html/), and the International World Wide Web Conference series was established (see IW3C2, 2001).

In late 1994 two Southern Cross academics hatched the idea of staging a national Australian Web conference. Subsequently in April 1995 the first AusWeb conference was held at Ballina in NSW. The series is now entering its 8th year and has established itself as Australia's National Web Conference (AusWeb, 2001). It was recently granted the status of an Endorsed Regional Web Conference by the IW3C2.

Early Web-based courseware development initiatives (1995-1997)

In 1995 a number of proposals were developed and circulated for new course development and delivery systems. These included a "Network Learning" model and a model for "Telecommunications-based Education". Each of these proposals sought to integrate the Web onto existing traditional forms of course delivery (Chua, Debreceny and Ellis (1995), Debreceny, Ellis and Chua (1995), Ellis (1995 a & b), Ellis, Debreceny and Hayden (1995)).

These proposals sought to create new pedagogical formats that incorporated the unique features of the rapidly evolving Web technologies (eg Java applets, animation, streaming video and audio etc) as well as providing improved information organisation/representation and more efficient distribution systems. They also sought to challenge the need to differentiate between on-campus and off-campus (external or distance education) students and to provide equitable communication and collaboration opportunities for all students regardless of their geographic location or study pattern (full or part-time).

In 1996 the School of Social and Workplace Development offered a fully online post-graduate unit in Futures Studies. This was an exercise in top-down curriculum design with all study materials, interactions and assessment being handled online via the Web and email. Full details of the unit are provided in Ellis, Wildman and O'Reilly (1996). In 1997 the materials for a further 10 post-graduate units were moved online using existing materials already produced in traditional paper-based distance education format but adding a discussion listserv and additional hypertext reference lists. This could be characterised as a bottom-up approach to curriculum design. Staff in other Schools e.g. Commerce and Management, and Exercise and Sports Science also began to offer some course materials online using the bottom-up approach.

At this time the University funded a three year Technology in Learning and Teaching (TiLT) project whose brief was to encourage and support development and use of information technologies in the learning, teaching and other scholarly activities of the University. TiLT assisted in development of Web-based courseware and associated technologies and support systems, provided limited training and development programs for staff, including an online self-paced Web development course undertaken, at least in part, by over 140 staff.

It would be reasonable to conclude that at the end of 1997 the average features and functionality of Southern Cross Web-based online units were comparable to the median of sites described in an extensive survey carried out by Mioduser et.al.(1999), that is, they were not outstanding and indeed most of them lagged behind expectations and the advanced capabilities of the available development systems. In order to stimulate more sophisticated and more extensive unit development lobbying began for special funding. At the same time, educational designers were employed within the Teaching and Learning Centre to provide academic support in creative pedagogical design for the new learning environment.

Full-scale Web-based courseware development (1998-2000)

Late in the second half of 1998 the University Executive took the decision to allocate specific innovations and development funding to two major projects that would develop and deliver two entire degree courses online: A Bachelor of Social Science and an Associate Degree in Paralegal Studies.

The first stage of development of each course commenced in the second half of 1998. A project management methodology was employed to facititate the integration of discipline expertise, educational design, technology and learner support components. In the School of Social and Workplace Development this involved a multidisciplinary team working to prepare 5 units for delivery in first semester 1999. In the same timeframe the School of Law and Justice targeted the development of 2 units. Each School prepared a detailed project plan

involving development, delivery and evaluation stages under which extra new units would be brought online each semester until the academic program structure was complete.

In order to gain consistency and efficiency the formal decision was made by both Project Boards to adopt LearningSpace (http://www.lotus.com/home.nsf/welcome/learnspace) as the course delivery shell. This decision was taken quickly without completing a detailed evaluation of the product but more or less going on the reputation of the company behind the product. IBM/Lotus LearningSpace is part of the Lotus Notes suite of products and enables users to access their materials, collaborate with peers, work off-line (using proprietary client software) and submit certain types of assessment. As a regional University working with a limited telecommunications infrastructure, one of the key features which initially attracted SCU to LearningSpace was its capability for users to work with the full study package entirely offline, logging on briefly to communicate and receive updates to the teaching resources.

Whilst the underlying structure of the LearningSpace system obviously suited its corporate origins, it did not translate at all well to the SCU academic/student environment. Busy academics with no Lotus Notes experience found the product difficult to use, the issue of client installation and use proved problematic (Patterson, Ellis and Brice, 2000) and student support needs became excessive. As a result of all these factors in December 1999, the University's Executive accepted the internally published evaluation report (Hayden, Saenger and Parry, 1999) and recommendations of a special working party that the University migrate to Blackboard's CourseInfo, now simply termed Blackboard (http://blackboard.com). The transition was slated to occur in the 2000 calendar with all support for existing LearningSpace materials being phased out by 2001.

Adopting Blackboard CourseInfo has also allowed the concept of a personalised Web page homebase (or "portal") for students to be realised. All students at the University, regardless of whether they are engaged in online units or not, can now log in to their own Web portal called "MySCU", and from there access a range of intranet services; a calendar and tasks area, links to their units, as well as links to the Library, Computing, and other student services currently available. This personalised portal is a synthesis of the functionality of the Blackboard CourseInfo application and the student intranet resources and services.

Support and training for staff in using Blackboard CourseInfo was an important priority. Whilst the application is an easy-to-use, intuitive program, staff are encouraged to take advantage of the short orientation/training sessions held regularly throughout the year. An email helplink and Web site resource provide follow-on support. Students are being supported in accessing and working in their Blackboard CourseInfo environment by online help, phone and email services. Consultation on pedagogical design is accessed by teaching staff via the Teaching and Learning Centre's program of individual, group and institution-wide support services.

In first semester of 2000 nearly 100 individual units had an online dimension to their delivery, from supplementary resources and interactivity to full Web-based delivery online. In addition, about half as many again were in the process of development for delivery in 2001. By the end of 2000 the transition from LearningSpace to Blackboard had successfully been completed and at the commencement of 2001 over 150 units were on offer with a variety on online functions embedded.

The Future: Consolidation (2001 and Beyond)

Oliver (2001) proposes that four major areas of concern that need to be addressed if the adoption and sustained use of online learning in Higher Education in Australia is to be successful. The areas he considers important are: the establishment of cost effective practices; the achievement and maintenance of quality in online learning delivery; ensuring access and equity in delivery of programs; and establishing practices which can enable online learning to be sustained and to grow as a mainstream activity in university teaching and learning. Oliver goes on to note that "while these issues are suggested as discrete entities, it is recognized that there is considerable overlap in the influencing factors and in the strategies and processes by which they can be overcome".

While the Southern Cross experience to date supports Oliver's proposals it also provides a more detailed break down of the major areas of concern into a larger number of specific issues and gives some indication of the basic problems that need to be addressed and the opportunties that are available. These include:

? **Developing new approaches to online pedagogy and assessment.** Recent Australian research (Alexander & McKenzie, 1998) highlights the disjunction between expectations of students and staff, and their actual experiences with technology . The significantly improved attitudes of students to their learning (16% intended

improvement; 62.7% actual improvement), was sadly not matched by improved quality of learning (87% intended improvement; 37% actual improvement). The enthusiasm of students and staff to new opportunities promised by elearning opportunities were not fulfilled. On closer analysis the single major cause of this shortfall was that assessment processes were not changed to better suit, or indeed take account of, the unique context of learning as supported by networked computer technology (Alexander and McKenzie, 1998: 234).

It is important to consider the methods of assessment that apply in a range of discipline areas and are supported by both the capabilities of the technology and the staff. The e-learning environment has extended the range of skills to be assessed for example information literacy skills, publishing works online, participation in a range of discussion formats, multimedia simulations, web page design, collaborative and peer-reviewed tasks. Opportunities for new assessment methods are also afforded, e.g. MCQs, timed online exams, international collaboration, group projects, peer- and self-assessment with rapid feedback (O'Reilly and Morgan, 1999).

In this richly abundant and democratically delivered context of digital information, plagiarism is emerging as an important issue associated with assessment. Clearly, if students do not feel that the tasks they are required to undertake in the course of their studies are meaningful, fair and authentic, they may be more inclined to take a strategic approach. This approach to learning can range from lawful practices such as using tactics to impress tutors, through to dishonest practices such as cheating, simply to perform prescribed tasks and achieve the necessary grades. Assignments which address the plagiarism question through a need for authentic and sustained engagement over the study period and allow students to demonstrate their learning in the most relevant format are all now possible, and challenge existing teaching and learning practices across disciplines.

? **Student preparedness/IT literacy and support.** The e-learning environment places new demands on students. In the past the University has offered a Success in Tertiary Education (SITE) program. It now is preparing to offer something that focuses on success or readiness for elearning. Newton and Ledgerwood (2001) demonstrate the need to take an holistic approach to student support. They illustrate how a student intranet site can be used to provide links to counselling services, financial services and other support agencies that can all contribute to a student success in their studies.

? **Access.** The University currently operates a relatively small modem bank at its main campus and even smaller numbers of modems at several of its regional study centres. These have been heavily congested for a number of years. As a result of the rapid uptake of Internet access into Australian homes, business and community venues (e.g. libraries) the university has moved to recommending that students, particularly those studying units with a substantial online component, should take steps to gain independent ISP access via either home and/or their workplace. Thus what only a few years ago loomed as a large and expensive problem for the university has, for the time being, faded away as relatively cheap dial-in access (up to 56Kbps) which has become universally available. However, on the horizon looms the issue of broadband access. Currently costing 5 or more times the monthly cost of dial-in access, and not being universally available, it seems the issues of access will soon be back on the University's agenda. The access speed of students is intimately linked to course design and media richness, and what can or cannot be feasibly and practically delivered at various connection speeds. Rather than bandwith limitations disappearing in the near future (as predicted by some writers e.g. Downes (2000)), it may be that the digital divide between those who have and don't have connectivity is mirrored in another division – this time a bi-modal distribution based on those with high or low bandwidth access.

There is also increasing pressure from staff, particularly those teaching online, to have broadband access away from their offices (at home or on the road) to allow more flexible work practices. The challenge for staff will be to convince management that this is an opportunity cost that is worth incurring.

? **Equity.** At Southern Cross University, units which require connection to the Internet in order to satisfy requirements remain in the minority and are frequently optional rather than core complusory elements of courses. Compulsory online units will only be accepted by current students in courses where the Internet authentically represents the working environment, for example in disciplines such as information technology, multimedia and management. While students continue to have an option to study in traditional on-campus or off-campus modes, the additional costs of study online are not a barrier, but a choice.

In the case of online study, efforts are made at SCU to ensure compliance with the guidelines for Web accessibility. Being an "equity" institution, a strong awareness exists to consider screen design and printable pages as well as ensuring alternatives are available to students for communication and interaction.

? **Timely resource development and reusable learning objects.** Another exciting challenge with e-learning is that of developing material that is up to date and maintaining its currency. In the case where online material dates much faster than print materials, SCU often explicitly requires students to develop good information management skills and might also request permission from students to reuse the data they generate, for future cohorts. This helps staff to keep up to date as well as effectively expanding their teaching resource base.

Opportunities are also more available for developing just-in-time training and performance support. E-learning systems mean that education and training no longer needs to be the front-end-loaded model. Subjects in applied areas such as research in natural medicine are continuously revised through dynamic student input together with additional knowledge-building by academic coordinators. Staff development is also timely and responsive.

? **Staff development for e-learning.** This is a key challenge if long term, sustainable change is to achieved. Strategies need to be developed, adopted and funded. Ellis (1999) and Ellis and Phelps (2000a and b) outline what can be achieved by a structured and multi-pronged approach to staff development and support. Moving into the elearning enviroment is a chance to either de-skill staff, by having the new work done for them, or re-skilling staff by providing them with the training and tools to work in this new environment.

At present Southern Cross is undergoing a major re-structuring of its administrative and support services. This review will include the issue of how staff development can best be provided and will address the need for not just initial training in new areas but also for ongoing support and training, as upgrades, new software and hardware become available. Hopefully these activites will be regarded as productivity investments not just costs (Ellis, Debreceny and O'Reilly, 1998).

? **Administrative and other system readiness.** The maximum benefits of developing a technologically advanced e-learning system will only be achieved if related systems are also updated and integrated. At Southern Cross University students can already obtain examination results via the Web and work is in progress with a new student administration system which will address issues like online enrolments and financial payments, direct student acesss to, and control of, personal information etc. The University's student portal system, "MySCU" is used to encourage students to customise their own online site. At this time, six other Australian universities have also invested in developing similar facilities.

? **Technical support and the scalability of support.** There needs to be major 'behind the scenes' planning and funding if increased demands on IT infrastructure and associated support services, such as help desks, are to be able to smoothly and seamlessly handle increases in demand generated by expanding e-learning activities.

? **New technologies, new work practices.** Perhaps the most difficult issue to predict is just how far and how fast innovations in elearning environment will move in the next few years and what demands such moves will place on existing resources and established practices. Whatever the pace, the adoption of appropriate change management strategies will be central to the success of any enterprise-wide adoption of this new learning and teaching environment.

Concluding Remarks

We have described the developments experienced at Southern Cross University from early adoption of the World Wide Web to its move into the e-learning environment. The current task, which will probably extend over the next decade, is to consolidate elearning provision as a mainstream activity, to make it a part of everyday university culture and to make sure that it can be sustained without the need for special funding.

The establishment of cost effective practices will include the reuse of learning objects and the integration of teaching approaches with streamlined information management systems that are easily (Web) accessible by both students and teaching staff. The achievement and maintenance of quality in elearning will need to be supported by the continued employment of some specialist educational design staff and the adoption of a multi-disciplinary staff development action learning approach to course design.

To date moving the online components of teaching and learning into mainstream adoption has been specifically enabled through the benefits of a scalable product such as Blackboard CourseInfo. Design for optimal Web accessibility has included considerations of regional infrastructure, equity characteristics of our student group, extended student support services and customisable portal features.

Change management continues to require a multi-pronged approach to staff development, administration and policy development being accomplished through a dynamic and diverse range of activities. The next 10 years of online teaching and learning at Southern Cross University promises to bring students increasingly together in an online/e-learning environment, and to generate active learning outcomes and provide peer support irrespective of geographic location or enrolment pattern (full or part -time).

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Five Years Virtual University – Review and Preview

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Abstract: In 1996 the Virtual University (VU) started as an online learning project at the University of Hagen with a few courses and a small number of users. Today the Virtual University has grown into a large learning platform with a student community of more than 10,000 and more than 200 learning events online. This paper describes some of the experiences made with development and use of the Virtual University, and in particular outlines the variety of effects on all areas of the university. Not only has the learning environment and process of students changed dramatically, but faculty, administrative staff, and technical support personnel have experienced fundamental challenges and reorganizations.
The virtual university is leading towards a major quality improvement in open and distance education. Many papers describe technical, didactical or legal aspects: this one aims at giving an insight into the complex impact on the whole organization.

Paper Outline

This paper describes how a research initiative, the Virtual University project, grew into a project that changed the appearance and the processes of a whole large organization, the University of Hagen. The paper presents a short review of how the project developed, and then explains how the different user groups were affected by the new teaching and learning paradigm. Finally, some necessary further developments are outlined.

1. A brief review

As life-long learning is getting more and more essential in professional life, learning via Intranet and Internet is becoming more an more popular and successful and distance learning is getting more important. The University of Hagen has an experience and a tradition of distance education since more than 20 years. Therefore, it was a logical consequence to use the Internet for learning and teaching purposes. The benefits of distance education, time - and location independence and the advantages of the Internet (fast information, easy communication and co-operation possibilities) were combined in the project Virtual University, Germany's first university to offer all its services in the internet. The Virtual University (VU) is a model for a modern education system.

The project is experimenting with and evaluating different forms of teaching and learning in the Internet. When the project started a suitable software platform was not available for our purposes, so a platform was built based on Internet technologies and a commercial database system. It is a virtual university system that integrates all functions of a university into a complete, homogeneous, extensible system with an easy to use and intuitive student-centered user-interface. The project started with only a few courses of electrical engineering and computer science, however, courses and events from all department were moved to the system over time. For instance, after the first year more than half of the courses came from humanities. This clearly contradicts the original assumption that web-based learning would be accepted easily by the technical departments and their students, but would be accepted very slowly in non-technical departments. Currently, more than 10.000 students are using the Virtual University of Hagen. Since the beginning of the Virtual University more than 200 virtual learning events took place. The

experiences are positive throughout.

The functional structure of the Virtual University was surprisingly stable over the last five years. Even though the graphical appearance was reworked completely, the organization of the information space did not change at all. Of course, the technical infrastructure has been continuously improved. The most important and critical extensions of the systems over time were tools for the staff and for administrators. This is an ongoing effort to improve efficiency and usability, especially for non-technical personnel.

The home page of the Virtual University offers the following functions:
education - for participation in courses, seminars, practical training and exercises; *news* - a campus wide blackboard containing all sorts of up-to-date information relevant to the users of the Virtual University; *office* - the component including administrative functions; *research* - offers access to all research-related activities in the university; *cafeteria* - a forum for social contacts between students; *library* - offers access to both traditional and digital libraries , *information* - provides general information about the university; *shop* - offers all material that can be purchased from the university

2. Impacts on Learning, Teaching and Management

2.1 Impacts on Learning

The experiences made with all types of teaching events (courses, seminars, exercises, practical training, etc.) were absolutely positive. For instance, a user survey in 1999 showed, that the intensity of the contacts in virtual seminars is substantially higher than in conventional seminars, also the readiness to form working and learning groups. Most students expressed the opinion that the discussion quality is higher than in conventional seminars. The majority of the students scored the offer of online-seminars with "very useful" (Mittrach 1999).

Another aspect is the dropout rate, always a problem in open and distance teaching. The drop out rate in the virtual seminars was significantly less than in conventional seminars.
What are the reasons for such improvements?

2.1.1 Communication and interaction

The students in a distance teaching environment essentially work by themselves, except for the very rare events where group work on the campus is required. This easily leads to a feeling of isolation, emotional distance and helplessness. Hence, it does not come as a surprise that the major impact of the Virtual University derives from the communication and cooperation features it includes and stresses. Where the students feel connected, they have a much lower tendency of just giving up and leaving, which, in other words, explains the better success rate in the Virtual University.

In the Virtual University communication and interaction possibilities are connected with teaching and information material everywhere. At any point inside the learning material students are able to enter a discussion group, to write an email, check the newsgroup, even to start a video conference (if available, but most students prefer text-based communication). Technical possibilities are interlinked and presented in a user-friendly way. Students are now able to search in the library, to do online exercises (e.g. compiling programs, fill-in text, simulate processes, etc.), to track the status of their corrected tasks (sent in, in progress, corrected, and finally the results), to archive their results and, very important, to communicate with each other and with the teacher.

Our experiences show that the majority of the students prefer asynchronous communication media like email and news, because of their time and place independence. The favored synchronous communication tools are text-based tools like chat. Videoconferences are mainly used for consultation-hours and oral examinations.

2.1.2 Tutoring and Student Support

Nobody should be left alone with a problem in the VU. Suitable communication partners can be found in the information area (common information), in the teaching materials or in the newsgroups. It is essential to support all kind of contacts: between students, between students and their teachers, and between students and organizational staff.

Newsgroups and email were not a novelty at the University of Hagen. These tools have been used some time before the VU. However, a new quality was reached through the Virtual University by the fact that communication became *context-oriented*, available in all situations and at all times. Students do not need to change between different tools, websites, etc.: all functions required are presented in a context-oriented way in one learning environment. Moreover, various mixtures of digital communication became a central medium for certain teaching events like seminars.

2.1.3 Topicality

It turns out that the Virtual University contributes to more up-to-date and consistent information and documents for students. Prior to the VU a lot of redundant and sometimes even contradictory information was available, course material contained errors and was not always up to date. Now information could be delivered just in time, mistakes can be corrected instantaneously, and difficult issues can be explained with additional information given in an ad-hoc way.

Students reacted soon to these dynamic possibilities of the VU: they show up, if mistakes are found and issues are explained poorly.

2.1.4 Applicability

Students have now the ability to learn directly on-the-job, to take part in cooperative processes, to initiate and to work in virtual teams. They learn to organize themselves and to produce high quality solutions within a group. The direct access to different information resources is a great support for our students and prepares them for typical work-environments in industry. Especially our working students (80% of all students) have a direct advantage of these experiences.

2.1.5 Innovation

The communication and interaction possibilities and the integrated technical features create new forms of teaching methods. Not only practical training, but also online exercises, virtual laboratories, interactive training (fig. 1) and virtual seminars now are common in the VU. Students evaluate the interactive elements as a great support for understanding complex topics. Among these interactive elements are virtual laboratories, simulations, style checking and compiling programs in exercise environments, graphical exercises etc. The following two examples illustrate some of the new learning methods which are typical for the VU.

2.1.5.1 Example 1: *Real systems in the virtual laboratory*

In this new environment we can run practical training from the distance even for systems only available at central locations. An example is a robotics practical training: the user writes the control software for the robot, then transmits it to the robot in the central lab, where the robot executes the commands it receives. The user can closely watch the robot's behavior via video, and can thus see and hear what happens, instead of just getting feedback data from a simulation system.

This kind of learning and experimenting from the distance also is of special interest for continuing education, technology transfer and industry cooperation.

2.1.5.2 Example 2: *Virtual seminars*

The virtual seminar has already been mentioned several times in this paper. It is one of the didactically challenging teaching events at the Virtual University, as seminars have traditionally been defined as teaching events with teacher and learners present in one location, and nobody ever tried to do seminars at a distance. Virtual seminars are very popular among students.

The Internet services used for such a seminar are email, ftp, news, chat, audio- and video conferencing. Services are specifically combined for different seminar phases. There are also mixed forms between virtual and conventional seminars, e. g. only certain seminar phases are assisted by Internet-based tools

The virtual seminar allows a well-structured teaching process using online as well as off-line communication tools which support the student's learning success. Seminars get a new quality: In contrast to conventional seminars a continuing learning process is triggered, and the discussions taking place in the Internet are much more structured and disciplined than in conventional seminars (Feldmann 1999).

Internet based communication tools enable and motivate very active communication, co-operation and discussion processes. People really interact as opposed to the typical traditional "listen and then (maybe) ask a question" behavior. The forming of groups and learning together in the net are new and highly valuable experiences for the students.

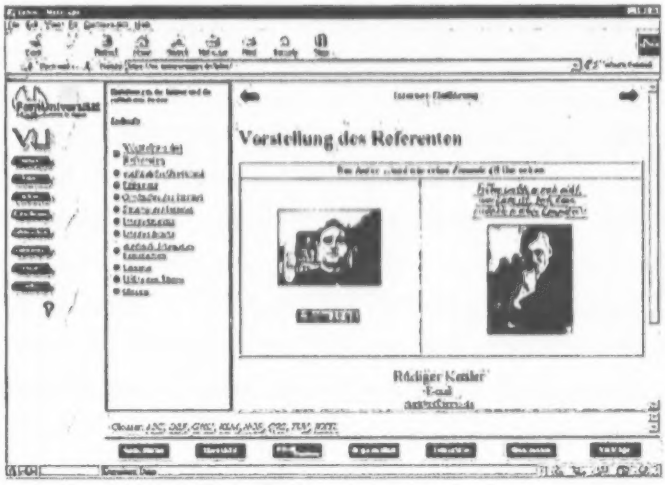

Fig. 1: A student's contribution

2.2 Impacts on Teaching

Most papers on virtual universities focus exclusively on the students. Let's have a look at the teachers. If done wisely, teachers benefit from a VU approach; if done naively, teachers may easily get drowned in communication, email, etc. At the University of Hagen teachers are professors, research assistants, mentors in the study centers and tutors (whose task is to correct student exercises).

No need to say that the success of a VU approach completely depends on the positive attitude and active participation of the teaching staff – but important to note, that this is the major hurdle in real-life when it comes to implement a VU! It is easy to get enthusiastic students, but a completely different job to motivate the staff.

For the teachers everyday life changes in the VU. More and more, the teacher gets to support the student's learning process, to organize learning, to act as a guide, instead of delivering information.

Not too many of our teachers liked the idea of changing their everyday life, but experience showed that their prejudices (e.g. to get too many emails or to have problems with the technology) were not confirmed once they kept to certain rules. This, however, required some creativity and much patience on the part of the VU developers.

Let us highlight some of the major changes experienced by the staff:

2.2.1 Communication and Interaction

The easy availability of Internet-based communication media made people assume, that students will use these tools in such a frequency and in such numbers that teachers would be overloaded with masses of questions, requests and comments. If not done properly, this of course may be the case, but if the philosophy is to imitate the students' behavior on the campus, then something different will happen: students start to organize themselves in the newsgroups instead of going for the teacher all the time. The reason is that the teacher is not always available, will take some time for a reaction, but other students are always out there and somebody is always ready to jump in. Thus, the teacher can concentrate on the issues that produce serious problems for students, and can sometimes lead

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the discussion where necessary. It is essential for the teachers to organize and if necessary to delegate communication processes (e.g. generating FAQ, editing drafts for common questions, organize cooperative work).

2.2.2 Tutoring and support

As mentioned before, teachers worry about the changes in their daily work. To support our teaching staff, we implemented (and are still implementing) a variety of different tools, such as emailing to different user groups, a campus-wide easy to use blackboard, the automatic generation of newsgroups for new learning events, and so called "teaching assistants", software packages that help to set up, structure and run complete courses or seminars. Shortly the teachers learned about the major benefits in their daily work:

- students have rather good contact to tutors, they know their students much better than before
- continuous communication between the students and the teacher throughout the courses, so it is now possible to track the learning process and to intervene on time before a student drops out or fails an exam. Homework is much better than before, even better than homework typically is at a campus university.
- discussing questions and problems is time - and cost-effective
- building of learning and working groups is possible, students support each other instead of looking for help from the teacher
- it is possible to find overlaps in the student's topics and to provide hyperlinks to each other's contribution
- if classroom phases are integrated in a course, these can be used for discussions on a rather homogeneous starting basis. Furthermore, the time needed to get to know each other is shorter than in conventional courses

2.2.3 Topicality

The topicality of documents is one of the main advantages of web based teaching material. Instead of writing one document and then sending it to the students, there is now a continuos process of correcting, adding information, and updating information. Students now expect up-to-date material.

The fear teachers have is that it is too much work to update data in different systems and to archive different versions of one course (students must have the chance to be examined according the version of a course they were enrolled in, even if this version is an older one). However, with the appropriate data management system and integrated version management these processes can be supported in a very user-friendly way.

Another important support feature is to install easy to use upload possibilities and a clear navigation structure for the existing material (authors and teachers are not always the same persons).

2.2.4 Applicability

Applicable contents are a quality requirement for a university with more than 80% working students. The Internet is a highly usable instrument to collect and present applicable contents. Searching, retrieval and publishing is a lot of easier for the teachers using modern technology. Most of our teachers using the VU were inspired by the new publishing possibilities, even though they had to spend some hours in creating web content. To support the teachers, the VU developer group provided their experience through hotlines, tutorials, etc. This support was essential for a positive motivation of the teachers.

2.2.5 A Word about Innovation

Innovation is a coin with two sides. On the one side there is the potential to simplify daily work by the use of innovative technology, on the other side are the people - responsible for the use of innovative tools but feeling uncertain in this new world - and thus tend to keep to traditional patterns.

Our teacher interface, personal assistance and the demands of our students helped them to see the benefits, to improve the daily work and - as a result - to convince colleagues to participate in the VU.

2.3 Impact on Management

The third group concerned of the VU is the university management. The management's responsibility is usually the enrolment process, administration of students data, student information, billing, etc. – shortly all organizational tasks around the study. In the beginning of the project nobody inside the management realized the Virtual University platform with it's few users and they even don't want to recognize it. Now, five years later, a lot has changed for managers and their staff.

To deny an increasing number of students and their demands was not possible. More and more students started to study virtually, and surprisingly more and more tutors and teachers used the system to support their work, and even the management staff utilized the system to search for information, to get an overview about the latest news, to announce new information for the students, etc. In the second year, the VU caused several problems: More and more students wanted to download their courses directly through the web, with the consequence to find new billing processes for them. They demanded electronic enrolment and more electronic course material.

Furthermore the stock increased, thus data transfer had to be automated. Teacher and tutors refused to feed in their data in different systems, so a synchronization of VU and organizational systems became necessary.

The general management of the university realized the potential of virtual teaching. In 1997 they started to promote the system in the different organizational areas. By the help of additional money for extensions of the VU, for electronic study material and other improvements around the virtual teaching and learning area the ground for further developments was ready.

2.3.1 Computer Center

The largest visible impact is the delivery of the whole system to the university's computer center, because it is not possible to run a system with more than 10000 users as a research prototype with only a few persons. To become the delivery successful many changes and improvements had to be implemented. E.g. the database (Sybase) had to be changed to the official university's database, an Oracle database. Passwords and the whole VU stock has been transferred to the computer center's database.

2.3.2 Printing and Shipping Department

The delivery of the study material will change in the future, more and more students download their material, the shipping of documents will decrease in the long last. Therefore the tasks of the shipping department are changing, not all people are liking such developments. Instead of producing paper material the shipping of CDs with large data, videos and audio data will increase. The production process of paper teaching material had to be synchronized with the electronic material, to avoid irregular contents. A professional content management system could be a possible solution for this problem.

2.3.3 Study center

The study centers modify from an university bureau with several administration and support facilities towards modern communication and support centers, serving the students the necessary technical equipment and support in using the VU. The external tutors in the study center itself use the VU as a tool to administrate their own teaching events (e.g. exercises) and to inform about the current courses and about the students enrolled in this courses.

3. Preview

The transfer of the software platform to the university computer center could not be the last thing to be done. The increasing number of users and new technological developments require new and better tools for the VU. The most important running improvements are the following:

- **Tutor support tools:**
  The existing tools should be extended with better possibilities to manage News, Emails, cooperative workspaces. New workflow components could ease the daily work of the teachers.

- **Communication and interaction:**
  Integrated instant messaging and a pool of available communication profiles should support the important communication and interaction processes.
- **Data management:**
  This component is essential for a smooth and secure handling of the complex universities data stock.
  Furthermore a professional content management is necessary to optimize the process of editing and publishing learning materials in different systems.
  Another aspect is the congruent data management, which is currently in progress with a new developed core data base for all organizational data concerning the different courses.

4. Summary

The Virtual University project was a real success in the sense that it developed from a research initiative into a comprehensive change of the whole university.

Students, teachers, and administrative staff have contributed to this transformation. A major driving force, though, were the students: once the project was under way, the number of participating students increased fast, as did their requirements, so that the development could hardly be stopped or neglected.

The large number of participating students finally forced the university to accept the project developments as a general service and to move the infrastructure and the support services from the project into the university computing center. The consequences for the university organization were underestimated at first, but the problems were solved as more and more persons accepted the approach.

The overwhelming success of the project triggered the foundation of two start-ups which make the know-how of the Virtual University developers available to industry.

The students feel that the quality of their studies has substantially increased, the teaching staff is finally getting used to the new form of teaching, computing center and study centers are catching up with their new role and change of daily work.

The main lesson we learnt is that, in order to get this kind of project accepted, all user groups must be involved at the earliest possible time. This includes administration, which is often overlooked, as many processes and tasks change in a fundamental way on the road to a virtual university.

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Steps towards the Design of Attractive Virtual Spaces for Tele-Learning

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Abstract: An approach to the design of so-called *attractive* virtual spaces in the context of tele-learning is proposed. Initial formal definitions of the concepts of virtual (communications) spaces and *attractive* are outlined and steps towards the construction of such spaces are given.

Introduction

The work in progress reported in this paper is a continuation of previous work on the construction and testing of virtual communications spaces for use in creating *attractive* Internet/Web-based environments for tele-learning (Sogabe, Mase, and Finley 2000). In this paper, an attempt is made to relate the spaces created, or, more precisely, the underlying Internet/Web-based systems that support these spaces, to critical human factors, such as willingness-to-pay, (user) satisfaction, and the like expressed as utility functions (Akimaru, Yamori, and Finley 99) (Yamori 99). Once again, the M^2COTS ("mass-market components off-the-shelf") approach (Sterling *et al* 99) is favored: as much as possible, standard, easily available, off-the-shelf equipment will be used for the experimental tests. The fundamental objective is to find useful design criteria for building tele-learning environments that will prove attractive to students and effectively assist in the recruiting of new student clientele (Finley 99). Currently emerging multimedia wireless and other wireless technologies such as Bluetooth (Miller & Bisdikian 2001) are expected to play a significant role in this work. For present purposes, the objective cited above is broken down into several basic steps: First of all, an attempt is made to develop a formal definition of the concepts of virtual space and of *attractive*. Then, these two will be juxtaposed to give an initial definition of *attractive virtual space*. Next, an initial design procedures for attractive virtual spaces will be suggested.

Initial Design Procedure for Attractive Virtual Space

The term virtual space has seen many uses and the authors have been inspired by such as Jensen (Jensen 99) and (Fernandez et al 2001). At this point, the definition is still incomplete, but essentially a virtual space, or more accurately, a virtual communications space, is a kind of topological space whose points will be users or internal network nodes and in which subspaces or manifolds will correspond to user communities, that is, aggregates of users, for example, as the members of an Internet-based discussion group. Neighborhoods, a fundamental topological concept, will correspond to the set of local devices surrounding the user, for example those linked by the Bluetooth technology or by a wireless LAN. These spaces have some continuous aspects, for example, the time axis or other dimensions corresponding to (digitized forms of) analogue phenomena in the real world and may be viewed from several points of view: the user's perceptions thereof, the designer's intentions, and the physical support. Of course, the user's perceptions should correspond to the designer's intentions and the physical support should realize these intentions. A formal framework for these concepts is currently being elaborated. As for the concept of *attractive*, intuitively this simply means "capable of attracting, intriguing, and holding the interest of members of a target population, that is, the potential candidates for using a given service." What constitutes *attractive* is a subject unto itself, but, via polling and interviews, the authors hope to be able to derive the major characteristics of a potentially attractive virtual space. Some simple examples involve properties that may be expressed as utility functions such as willingness-to-pay, user satisfaction, and the

like. If one takes, the virtual spaces that are effectively defined by cellphones among a population of teenagers (some of the most avid of cellphone users in Japan), one sees a number of properties that make those spaces attractive: immediacy of access, relative privacy, access anywhere, anytime, compactness of the physical devices themselves, the low cost of e-mail (as opposed to voice conversations), and other such attractive properties. Once identified such desirable properties, utility functions relating these properties to critical system parameters may be constructed. Such functions then may be optimized using genetic algorithms or other techniques (Finley 2000).

From the preceeding, the elements of a design procedure may be given. First, one identifies the various factors of conceivable interest to the target population, for example, such things as willingness-to-pay, general user satisfaction, user preference for such and such a feature, etc. These may be tested using polling techniques among the target population. Next, these factors may be related to certain critical system parameters, such as bandwidth, delays, screen definition, and the like, again using polling among the target user population. This will give rise to empirically derived utility functions which now may be optimized by techniques such as genetic algorithms. Thus, one would obtain a function, say, W, with

$$W = f(p_1, p_2, \cdots, p_n)$$

where the p_i are the system parameters of interest. Now, using an optimizining procedure, the values of p_1, p_2, $\cdots$, p_n that yield an optimal value of W may be found. The system then should be designed to conform to these values. Prototypes may be constructed to verify these results, which may, in fact, yield only an initial value which may then be refined by further adjustment of the p_i. At this time, tests are being conducted to determine essential factors for tele-learning environments. The results of these tests will be reported in future publications. Initial tests suggest that sometimes one single, simple factor might suffice for the systme to qualify as *attractive*.

Acknowledgment

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Understanding Computer Ethics

Under grants from the National Science Foundation, Educational Media Resources -- a nonprofit company -- has created an interactive multimedia CD-ROM on computer ethics. (The result of this work, a CD-ROM/book entitled Understanding Computer Ethics, will be published later this year by Prentice Hall.)

This paper, delivered by Dr. John Fodor (creator and author of UCE), will examine the topic of computer ethics as it relates to network environments. It will include the following areas:

Introduction to the field of computer ethics,
Origins of computer ethics,
Various definitions of computer ethics,
Approaches to computer ethics,
Significant ethical issues in network environments, and
Resources for further understandings.

Introduction to the field of computer ethics
The paper will start with an examination of the learning objectives that will result from the reading. In short, these include:

a. a basic understanding of this new field called computer ethics (a.k.a. technology ethics and information ethics),
b. familiarization with basic terms and concepts in computer ethics, and
c. acquisition of appropriate skills to anticipate and/or handle computer ethics problems when they emerge.

In keeping with this introduction, a fundemental distinction will be drawn among the various levels of computer ethics: Pop, Para, and Professional (i.e. the various ways in which one can be "doing" computer ethics).

A final point of the introduction is to review the practical reasons to justify the study of computer ethics. One of the most obvious practical reasons is the financial loss resulting from breaches in computer security, computer privacy, ownership of intellectual property, and professional responsibility.

Origins of computer ethics
Next, video clips will be shown of several historic figures in computer ethics. These include Walter Maner (who coined the term "computer ethics"), Donn Parker (who wrote the first codes of ethics for the ACM), and Deborah Johnson (who wrote the first book on computer ethics).

Various definitions of computer ethic
Since computer ethics is a relatively new field, there are various definitions that are being advanced. The paper will examine some of these definitions and it will draw some relationships among them. For example, the paper will review James Moor's definition that computer ethics is the "analysis of the nature and social impact of computing" and "the formulation and justification of policies regarding the use of computing technology".

Approaches to computer ethics
Many valid approaches are available to study computer ethics, these include: Computer Science, Sociology, Psychology, Philosophy, Law, and Public Policy. The paper will briefly point out these approaches, and comment on them.

Significant ethical issues in network environments
Several important issues will be raised. Questions and answers will be provided on such topics as:

Privacy -
a. An examination of the Principles of Fair Information Practice,
b. Potential harms that need to be minimized when gathering personal data,
c. Considerations that are necessary to meet reasonable expectations of privacy,
d. Various rules of conduct for persons involved in the design, development, operation, or maintenance of any system of records,
e. Administrative, technical, and physical safeguards that should be taken to insure the security and confidentiality of institutional records.

Security -
a. Various ways in which computers are involved with crimes, and precautions which can be taken against each of them,
b. An examination of human behavior as it relates to security-relevant expectations,
c. Gaps in computer security and how they may be filled,
d. Vulnerabilities that are posed by administrators who lack sufficient knowledge to modify their systems.

Ownership of Intellectual Property -
a. Differences between trademark, copyright, and patent infringements by users on your system.
b. Institutional policies for protecting intellectual property by computer users,
c. Administrative safeguards that protect intellectual property rights,

Throughout the paper case studies will be used to illustrate better the concepts raised.

Evaluation/Performance Measurement & Assessment

Outcome Based Evaluation for on-line activities

This paper will examine Outcome Based Evaluation, as a measurement of performance and assessment for on-line activities. Outcome based evaluation, OBE, is the measurement of results. The types of evaluation examined herein will include specific on-line activities that involve demonstrations of skill; acquisition of knowledge; and changes of attitude or behavior for on-line users/participants. (Principles discussed in this paper can be applied to any project that has outcome goals.)

In addition to describing what outcome based evaluation is, this paper will review how outcome measurement differs from traditional methods of evaluating and reporting, why institutions should measure outcomes, and how to perform an OBE. The paper will examine the Government Performance and Results Act of 1993, which requires documentation of results of certain grant activities. Finally, sample questions and templates for outcome based evaluation will be provided, and resources for additional information of OBE will be given.

What is outcome evaluation?

Most evaluation tools fail to determine the impact of the products, programs or services they provide on those who use them, because they do not take as their focus the results, or outcomes, of the initiative. There is increasingly a convergence of thought among decision makers that institutions must begin to reshape their services and products by focusing more effectively on outcomes.

The IMLS defines outcomes as benefits to people: specifically, achievements or changes in skill, knowledge, attitude, behavior, condition, or life status for program participants. Any project, therefore, intended to create these kinds of benefits has outcome goals. Outcome based evaluation, OBE, is the measurement of results. It identifies observations that can credibly demonstrate changes. It systematically collects information about these indicators, and uses that information to show the extent to which a program achieved its goals. (OBE measurements differ in some ways from traditional methods of evaluating and reporting.)

Why focus on OBE?

Institutions spend billions of dollars each year to create programs and services. In order to understand the social and economic impact of these programs and services, it is essential to have a testing instrument that will accurately test for outcomes. Unfortunately, many individuals and organizations are not provided with adequate frameworks or tools to measure their efforts.

In other cases, such as government policies, certain institutions -- like museums and libraries -- are required by law to test for outcomes. For example, congress requires IMLS to document results of grant activities each year to meet the requirements of the Government Performance and Results Act of 1993. OBE reports show how effectively their grants make contributions to museum and library audiences.

The need for OBE in institutional and government settings, translates well to efforts on-line. Whether one is creating an on-line course, resource materials, or an e-commerce site; knowing the outcomes of the program and services will help to improve the contents and delivery.

Structuring an OBE
Creating an object based evaluation requires:

Realistic and measurable outcomes
Organizational capacities to implement and manage the evaluation

Outcomes that are related to activities
Goals that are realistic
Specifying program outcomes
Developing measurable indicators
Identifying data sources and data collection methods
Analyzing and reporting findings
Using outcome information

When creating a good evaluation instrument, it is important to begin with clear goals and objectives. These objectives should describe the change that is expected from the program. Outcome based goals and objectives are usually:

Specific - written to point the way to action.
Attainable - to increase the probability for success.
Quantified - to specify how much change is desired.
Measurable - to assess progress toward change.
Targeted - to identify who should change.
Time Specific - to tell when the objective is to be reached.

Goals and objectives that come as close as possible to fitting this profile are important because OBE focuses upon how well a program reaches its goals. And, the point of a quality evaluation is to make this focus as systematic as possible.

An evaluation matrix will be provided to help individuals create an OBE standard for themselves. The matrix helps to envision a wider range of data collection methods. Various collection methods will be reviewed in order to help create an OBE to meet various on-line interventions. These include:

Anecdotal Record Form
Formative Review
Implementation Review
Questionnaires
User Interface Rating Form

Outcome based evaluation does not invalidate other approaches. Instead, it augments them. OBE supersedes less formal modes of evaluation by cutting directly to the question of effectiveness. "In the end, however, only a demonstrably positive and intended outcome is sufficient." [All citations are included in paper.]

Specific on-line cases are given as examples to illustrate each of the points made above.

SONUS: SOFTWARE FOR DEVELOPING SKILLS IN ACCENTUATION

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Sonus is a design software created to develop basic skills in accentuation used in Spanish words. It is divided into four parts, each one of them develops an specific skill. Each part contains three main processes: *diagnosis, study or review and evaluatio.* Nowadays, Sonus is used for more than three thousand users such as professors, office workers and students, inside the Sistema Tecnológico as well as other places.

1 Introduction

Sonus is a program designed to practice and improve basic skills of accentuation. Among these skills are: dividing syllables, identify accented syllables, classification of words and application of the accent rules.

Each one of these parts is divided into three basic activities:

a.- Diagnosis
b.- Study and review
c.- Evaluations

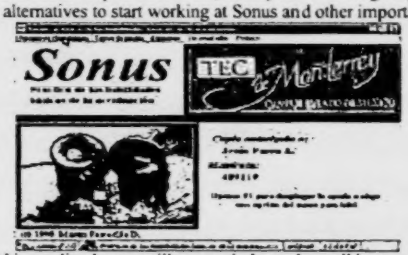
When these four skills are developed the student will surely know how to write correctly Spanish words.

2 Diagnosis

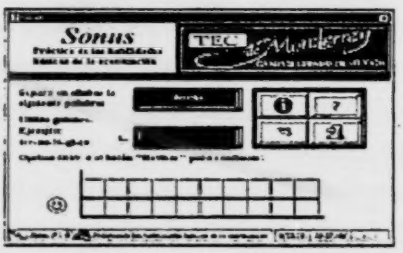
As a first step diagnosis evaluates how much the student knows about each one of the four skills. This evaluation is important because:

1) Gives the students quantitative information about each one of the skills, for example, number of correct and wrong answers, distribution of them in specific groups, etc.
2) Gives the students information about which topics has the major mistakes and must be reviewed.
3) Prepares students to know their weakness and anticipate the results, so they can reach higher grades in the exams.

The next graphic shows the students the different alternatives to start working at Sonus and other important information needed in this program.



To enter the first activity click on "Diagnosis" and immediately you will see a window where all instructions are given.



This activity gets through three important stages: review (shown in the last drawing), results and mistakes analysis graphics. Review is composed of 50 vocables which are selected from a group of 1500 words (so each review session is different from the other), in which the student should do different exercises such as dividing into syllables, identifying accented syllables or stressing different words. Once review is done, Sonus will display a graphic indicating number of right and wrong answers, types of mistakes distributed in order of importance, and final grade, as shown:

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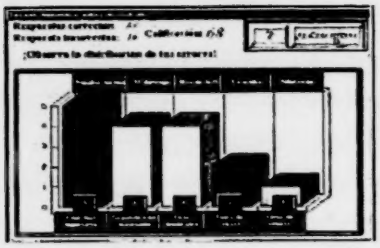
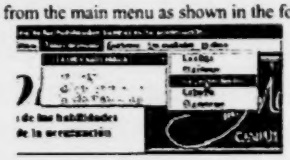


These graphics will give the student a general view of their mistakes. This diagnosis ends with a mistake analysis which helps the students compare their given answers to the correct ones. Moreover, the student has the chance to start studying just by choosing the suggested icon.

3 Review

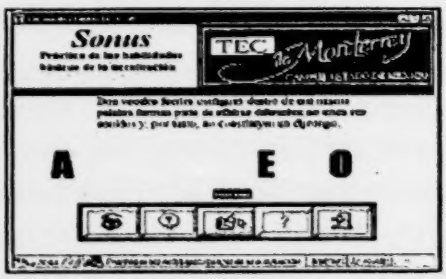
Review comes after diagnosis. It might be selected from the main menu as shown in the following drawing:



The main purpose of this activity is to study the topics in where the student have shown weakness in their knowledge. This activity is important because:

1) Offers the student the essential knowledge to understand the selected review topics.
2) Improve a specific skill by practicing and continuos feedback.

There are three steps to follow in the review process: exemplification, explanation, and practice. (In the following drawing an example of one of the review topics, stressed vowels, is shown. Each one of the steps is represented in the icons below:



On the supplied examples the student can work with a variety of words, in which different rules and principles are presented and must be learned by practicing and by reading the explanation. Even tough these are short they offer the necessary information so that the students can improve the specific skills. Finally, the students must practice the acquire knowledge either by separating words like in the diagnosis part or by games such as: Hangman. While practicing the students will receive immediate feedback indicating the correct answer when needed. After this, a grade indicating how much they control the topic will be displayed. This activity is very important, because if a grade upper than 91 is not obtained, the student can not go on with the corresponding evaluation.

4 Evaluations

In this activity the results of evaluations and grades are formal and helps the instructor and the student evaluate the progress in an specific skill. There are two different types of exams: thematic and personal. The thematic exam is a general review about the acquire knowledge and it consists of 30 vocables in which the student must divide syllables, identify the accented syllable, classify and apply the accent rules. On the other hand, the personal exams have the purpose of reviewing the mistakes made by the students during the diagnosis and review sessions, and give them a formal grade. An important point is that this evaluation is personal because it focus on the mistakes made by and only by the student. At the end, the average of the personal and thematic exams will be immediately kept at the student record.

5 The sequence of activities

The Sonus previously mentioned activities form the basic structure of it. Nevertheless it is not possible to do every topic at the same time. The student must start with the easier topics and finish with the difficult ones because it is necessary to have good knowledge about each of them to move forward. The requirements needed to access the advanced topics are:

1) Solve diagnosis and review exercises with an average grade upper than 90, which will immediately open the thematic exams.
2) Solve the thematic exams with an average grade upper than 90, which immediately will open the personal exams.
3) Solve the personal exams with an average grade upper than 90, which immediately open the next topic exercises.

In each activity, if the student does not reach the required grade, he/she must go back to the diagnosis exercises of the specific topic to start all over again. These requirements are explained in the following diagram:

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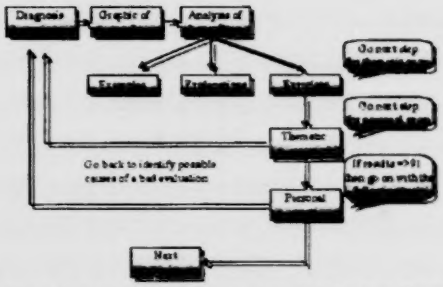
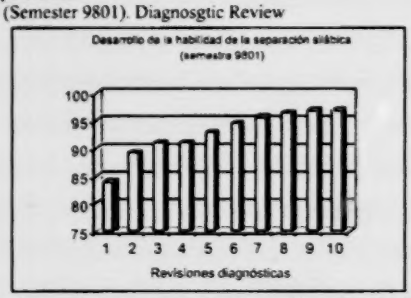


Sonus contains other important characteristics (not illustrated at this moment), which are: sound and on-line help. Sound is an important element in this program, because the student can identify, just by listening, different types of pronunciation. Sonus contains 500 different types of voices and pronunciations related to this skill. On the other hand, the on-line help carry the student through the program easily so that he/she will not be distracted in their learning process.

6 Sonus Results

Since 1998, Sonus has been used in different campus of the Tec de Monterrey like: Ciudad de México, Hidalgo, Querétaro, Irapuato, Guadalajara y Estado de México as part of some classes such as: Spanish Writing, Advanced Writing, Reading and Writing, Speech, all at college level. Results obtained with Sonus are shown in the graphic below:

Graphic: Development of dividing syllables skill (Semester 9801). Diagnosgtic Review



This graphic shows how 110 students increased their average from 84 to 96 during 10 diagnosis activities. Pointing this out, students who improved their grades throughout written reports also have shown an improvement in their skills. This software let the instructor focus his attention on research more than reviewing and feedback activities.

Sonus is not only for students, but also for training purposes to all personnel and the teacher´s staff. Another benefit is this software can be installed in the teacher´s laptops so they can practice on it during their free hours. Their progress has been similar to the student one; the following graphic explained the above situation:

Graphic: Development of dividing syllables skill (February 1998). Diagnosgtic Review

This graphic shows the fulfillment of a group formed by teachers and office workers who started with a diagnosis average of 73 lesser than the student´s average which was 84. Otherwise, this group progress was greater than the student´s group because after ten diagnosis activities they got an average of 95.

During a third experience with Sonus with a group of 28 students from a public high school on April 20, 21 and 22 of 1999; the skill tested with diagnosis and review activities was dividing into syllables. This group first average was 60.28 shown in the graphic below:

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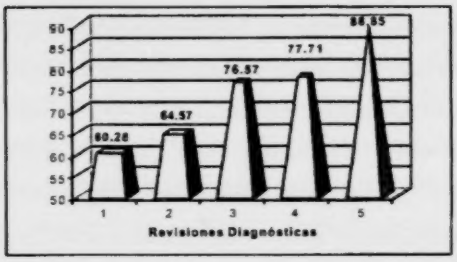
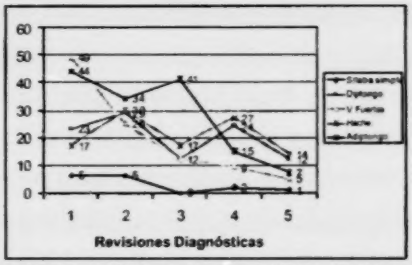


As in the first results, the second review average was almost the same, but as it was moving forward, the average got higher, almost close to 90. The difference between the second and the third average was that the students realized that they needed to study their weakness, they did so and as a result of that their score was improved. After this, the students attitude toward their mistakes was positive so each time they made mistakes, they went back and study them. So this is why their final average was almost 90. Now, as we can se this improvement has not been only quantitative but qualitative. The following graphics shows this fact:



(Note: Silaba simple = simple syllable; Diptongo = Diphthonge; V Fuertes = strongs; Hache = h; Adiptongo = Adiphthonge)

This graphic represents mistakes made during the diagnosis by seven of the 28 students. In their first session these students made 139 mistakes, specifically in the skills of adiphthong and accented vowels (93), however by fifth session the related amount of mistakes reduced evidently (12). This means that among all the different skills those were easily understood. On the other hand some skills like the diphthong and the use of the "h", are extremely difficult to understand and correct, as it is shown in the graphic This is why the instructor must pay special attention to those students who have difficulty in these skills.

To conclude we would like to point out that during the next months we will be checking the results of the courses given this semester to students and professors; however, we can see that they tend to improve as we have seen during this presentation.

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XML-Based Automatic Web Presentation Generation

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Abstract: This paper presents a method that automates hypermedia presentation generation on the Web. The method is based on RMM (Relationship Management Methodology) for aspects of hypermedia design. It distinguishes between the logical representation of the data and its actual presentation. Using new emerging Web technologies like XML (Extensible Markup Language) and XSLT (XML Stylesheet Language Transformation), we have implemented a prototype to experiment with the proposed method. Data filters written in XSLT prove to facilitate the multi-phase hypermedia presentation generation method.

Introduction

World Wide Web (WWW) is the most important platform for information exchange between Internet users. As a result there is an increasing need for methodologies that support the design of Web-based Information Systems (WIS) (Isakowitz et al., 1998a). We consider WIS that integrate heterogeneous data sources, such as XML repositories, relational and object-oriented data bases etc. A user asks a query to such a system and as a result a presentation is generated (De Bra & Houben, 2000). The main focus of this paper is the question how to automate the process of generating such hypermedia presentations.

Several hypermedia design methodologies are available, like RMM (Relationship Management Methodology) (Isakowitz et al., 1995) and OOHDM (Object Oriented Hypermedia Design Methodology) (Schwabe et al., 1996). The design method that we use here applies the core of RMM for reasons of its simplicity and its E-R (Entity-Relationship) foundation. Extending the well-accepted E-R model to model information domains, and subsequently adding navigation structures to it, proves to be a solid ground on which to base the automatic generation of hypermedia presentations.

Before we discuss the prototype implementation, we shortly mention the key concept (both in RMM and our specific design method) of 'slice', which is used to denote meaningful presentation units. A slice groups together attributes and possibly other slices. In order to have a uniform approach to slice hierarchies (Isakowitz et al., 1998b) we consider primitive slices to be attributes. Each slice belongs to an entity but it can contain also slices belonging to different entities: in this case, the relationships between entities which make such an embedding possible are indicated. If the relationships are one-many an access structure (index, tour, and indexed guided tour) is associated to the slice nesting. Many-many relationships (from the E-R model) are decomposed in two one-many relationships. There are two types of slice relationships: aggregation (presented above) and reference (hyperlinks between slices). For a particular application, the application model describes all slices and their relationships (Isakowitz et al., 1998b), thus specifying the hypermedia aspects of the application. Due to the fact that each slice is owned by an entity and encapsulates some of the entity's attributes we can view the application model as an extension of the E-R model, and thus as an important step in the design process of the hypermedia presentation.

Method and Tools

The presentation generation method is based on four steps which are depicted in (Fig. 1). In the first step, Data Cleaning, the data retrieved from the Data Retrieval module is adjusted to the specific format for E-R model instances. For each application, there is an application model which describes the slice relationship model on top of the considered domain model. In the next step, Logical Transformation Generation, a transformation engine is produced based on the specific application model. This transformation engine is used by the following step, Logical Transformation, to package the retrieved data instances into slices. The final step, Presentation Transformation, generates a presentation, e.g. in HTML, from the slice packaged data.

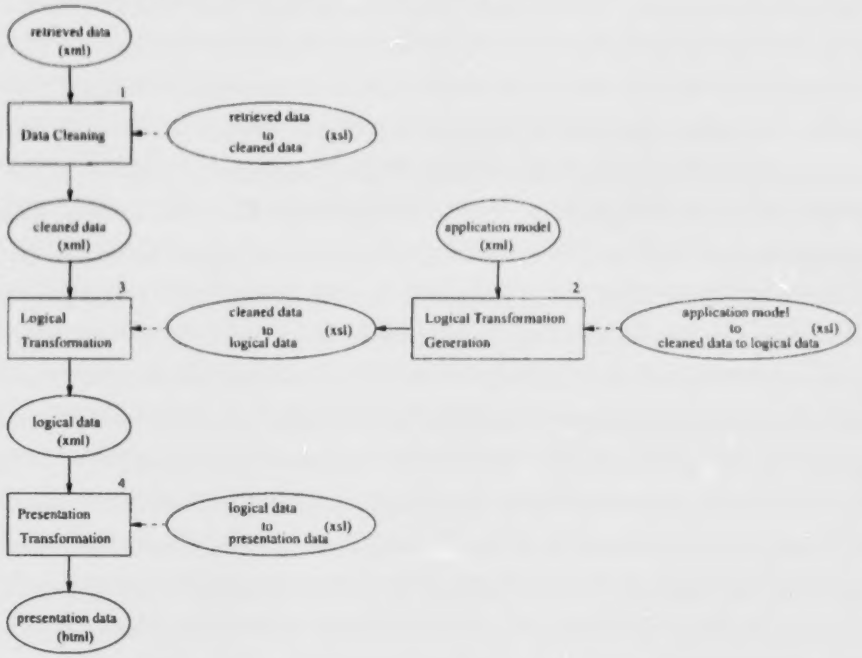

Figure 1: Method

The artifact of each step is a valid XML (Extensible Markup Language) (W3C XML Working Group, 2000, Bradley, 2000) file, that is a file that complies to a prescribed DTD (Document Type Definition) file. For the Logical Transformation Generation step an XSL (XML Stylesheet Language) (W3C XSL Working Group, 2000, Bradley, 2000) file is produced which is also an XML document. At the core of each step there is an XSL file which describes to an XSLT (XSL Transformation) processor how to convert the input XML file to the desired output XML file.

In order to experiment with the proposed method a demo was developed. The domain model of this application is based on the data provided by the Web site of the Rijksmuseum in Amsterdam. The prototype uses annotated Rembrandt paintings to exemplify the clair-obscur painting technique. As a software tool, the XSLT processor Xalan, provided by the Apache XML Project (Xalan Apache XML Project, 2000), is used. The next sections illustrate the different steps of the method for this demo application. Due to space limitations we can only show small excerpts of the software.

Data Retrieval

The demo considers one particular query, a restriction that doesn't affect the purpose of the presented method to show how to dynamically generate hypermedia presentations on the Web. The user asks a query to

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the system, a query which is expressed (in the current implementation) in SQL. The results of the query are encapsulated in an XML file which has three components: entity instances, attribute instances, and relationship instances. (Example 1) presents a small excerpt from the DTD used to describe the retrieved data and (Example 2) provides a piece of the retrieved data as an XML fragment.

Example 1 (Data.dtd)

```
<!ELEMENT attribute-instance (#PCDATA)>
<!ATTLIST attribute-instance attribute-id CDATA #REQUIRED>
```

Example 2 (Data.xml)

```
<attribute-instance attribute-id="attribute.technique.name">
<![CDATA[clair-obscur]]>
</attribute-instance>
```

Data Cleaning

The Data Cleaning step bridges the gap from the XML data representing the SQL output to XML data representing an E-R model instance. The transformation stylesheet of this step captures the domain knowledge to fill the missing data. Relationship names are added to the retrieved data and the inverse of the relationship instances is built (since they were not originally included in the data retrieved). (Example 3) gives a flavor of the XSL file that specifies the above transformations.

Example 3 (DataCleaning.xsl)

```
<xsl:when test="@relationship-id='painting-technique'">
    <xsl:attribute name="relationship-id">relationship.exemplifies</xsl:attribute>
</xsl:when>
```

Application Model

The application model is used to describe at the logical level the hypermedia aspects of the application (Isakowitz et al., 1998b). At this logical level, the slice types are identified. By slice type we mean a full specification of the elements (slices and/or attributes) contained in the slice, and reference relationships to other slices. In the introduction section we explained that the application model is an extension of an E-R model. (Fig. 2) presents the E-R model of the demo application. Note that we model pictures as URLs (Uniform Resource Locator), so all the attributes are of type text (string).

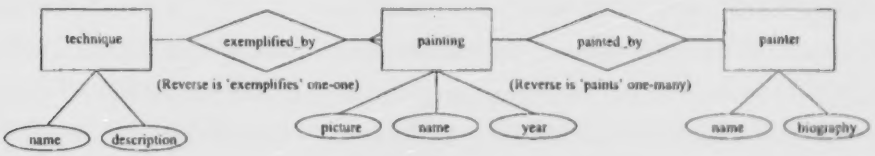

Figure 2: E-R model

(Fig. 3) gives the application model design for the application. There are two (non-primitive) slices, both of them called *main* that belong to two different entities, *technique* and *painting* respectively. The starting point of the presentation, that is *technique.main* (the '.' denotes the ownership relation between slices and entities), is indicated in bold font. *technique.main* encapsulates the *name* and *description* attributes from *technique* and an index structure of hyperlinks. Each of these hyperlinks has as an anchor the picture's *name* attribute and as target the slice *painting.main*. The slice *painting.main* is composed of three attributes of painting: *picture*, *name*, and *year*, and the attribute *name* of the associated painter. The entity relationships *exemplified_by* and *painted_by* are used to specify (at instance level) which attributes (instances) belonging to different entities are (logically) grouped together in the presentation.

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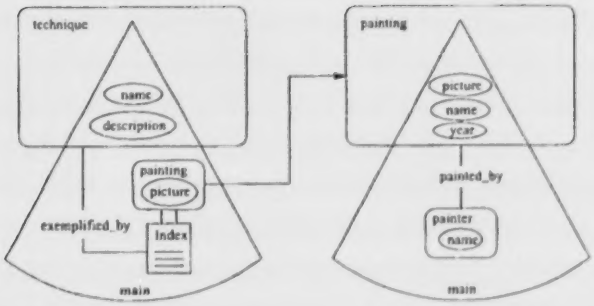

Figure 3: Application model

We encode slices as XML elements that can contain text (the so-called empty slice) (Isakowitz et al., 1998b), slice references, hyperlinks, index, and guided tours (Example 4). (Example 5) presents a small piece of the application model which illustrates the use of slice references in slice definitions.

Example 4 (Application.dtd)

```
<!ELEMENT slice (text | (slice-ref|hyperlink|index|guided-tour)*)>
<!ATTLIST slice id ID #REQUIRED>
```

Example 5 (Application.xml)

```
<slice id="slice.painting.main">
    <slice-ref idref="attribute.painter.name"
               relationship-ref="relationship.painted_by"/>
...
</slice>
```

Logical Transformation Generation

The Logical Transformation Generation step is responsible for building the main presentation transformation engine, that is the engine that packages the retrieved data instances into slices. It is implemented as an XSL stylesheet that generates another stylesheet (Lemmens & Houben, 2001). The input of this step is the application model encoded as explained in the previous section in an XML file. Knowing the type description of each slice, a stylesheet is generated that will transform data at instance level. An excerpt of the stylesheet implemented for this step is presented in (Example 6).

Example 6 (LogicalTransformationGeneration.xsl)

```
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
                xmlns:axsl="http://www.w3.org/1999/XSL/TransformAlias"
                version="1.0">
<xsl:template match="/">
    <axsl:stylesheet version="1.0">
    <axsl:template match="/">
    <xsl:element name="results">
        ...
        <xsl:apply-templates select="//slice-ref" mode="ROOT"/>
    </xsl:element>
    </axsl:template>
    </axsl:stylesheet>
</xsl:template>
...
</xsl:stylesheet>
```

One can observe that there are two namespaces defined for stylesheets, one for the current one and one for the output. For each slice reference a template is called in the mode *ROOT*, which generates an element of type *slice-instance* at the top level. Once a slice instance is encoded each reference to another slice (in its body)

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is replaced by a *slice-instance-ref* which points to one of the top level slice instances. The main slice type (the starting point of the presentation) is populated by all the instances of the entity that owns that slice. In case that a relationship is involved, only those entity instances that are related to the current entity instance via a relationship are considered. For attributes or slices that belong to the current entity instance the population is obvious, as the current entity instance is used.

Logical Transformation

The Logical Transformation step packages the data instances into slices (it provides instances of slice types based on the retrieved data). The stylesheet that performs this transformation was automatically generated by the previous step. The input of this step is an XML file containing the cleaned data, and the output is another XML file that describes the grouping of the input data into slices. (Example 7) illustrates how to retrieve attribute values from the input data.

Example 7 (LogicalTransformation.xsl)

```
<text>
    <xsl:value-of select="attribute-instance[@attribute-id='attribute.painting.name']"/>
</text>
```

Presentation Transformation

The Presentation Transformation step builds a Web presentation file. We used HTML for the code generator, but it can be any other hypermedia format supported by the Web. The presentation code generator is based on a stylesheet that takes as input the slice packaged data (the output of the previous step) and converts it to a HTML file, ready to be presented on a Web browser (like Internet Explorer or Netscape Navigator). (Example 8) indicates that for each *slice-instance* an HTML table is generated. For each *slice-instance-ref* a row is built in the table. (Fig. 4) illustrates the HTML representation of the *painting.main* slice instantiated with a painting by Rembrandt.

Example 8 (PresentationTransformation.xsl)

```
<xsl:template match="slice-instance">
    <TABLE>
        <xsl:apply-templates select="*"/>
    </TABLE>
</xsl:template>
```

Self Portrait as the Apostle St Paul
1661
Rembrandt Harmensz. van Rijn

Figure 4: HTML presentation

In collaboration with CWI, Amsterdam, an interface between the output of Logical Transformation and Cuypers presentation system (van Ossenbruggen et al., 2001) will enable the generation of a different, more customized presentation in SMIL (Synchronized Multimedia Integration Language) format.

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Hera Architecture

The experiences with this specific prototype are exploited in the Hera project (Houben, 2000), a research project that investigates hypermedia systems able to automatically generate presentations from ad hoc queries on heterogeneous data sources. Based on the principle of separation of concerns we distinguish two components in the Hera system: data retrieval and data presentation. Data retrieval is responsible for the integration (wrapping and mediation) of the different data input sources. It processes the input query and gathers the retrieved data. Data presentation builds a logical view of the data to be presented (it includes all the steps presented in this paper except for the last one) and outputs the (final) presentation (the last step of the proposed method).

Conclusions

In this paper we have considered an automatic presentation generation method based on four steps, and we have illustrated experiences from a prototype based on this method. Throughout the entire process implemented in the prototype the data is encoded in XML which proves to be an ideal format to store this structured data. We have shown how this XML data is managed in the generation process: for each step a data filter is written in XSLT, a standard supported by W3C for XML transformations. These data filters prove to fit well in our multi-phase presentation generation.

In the future we will extend this prototype (and apply it to different applications) in order to investigate: the extension of the system to multiple queries (based on slices), the impact of having different attributes types (besides text) on the presentation generation, different back-ends for the final presentation, and slices-on-demand (slices that are provided on demand, from a query, by a servlet).

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A multimedia collaborative learning environment: a visit to Allsorts Virtual Primary School

Fiona French, University of North London, UK; Ruth Wood, Kingston University, UK; Ian Cumpson, Univesity of Greenwich, UK

In this session, we will showcase the recently developed prototype of a multimedia collaborative learning environment - Allsorts Virtual Primary School - and we will present our evaluation of the prototype. One of the main aims of collaborative learning is to encourage debate and thereby facilitate a deeper processing of the subject matter by the participating students. In order for this debate to be structured and meaningful, there needs to be both shared knowledge and a shared sense of purpose amongst participants. This project is founded on the premise that a tutor-modeled multimedia virtual reality can help contextualise information and provide a highly memorable experience for users, by using multisensory representations that mirror the real world. We anticipate the session to be of interest to teachers, staff developers, researchers and multimedia designers.

A Multimedia KANJI Dictionary with Hand-writing Recognition for Students of Japanese as a Foreign Language

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Abstract: Dictionaries are essential for language education. Kanji is much more difficult to look up in dictionaries than English or most other languages. In a Kanji dictionary, one usually utilizes the "stroke count" or "pronunciation" or "radical" (root) to look up a Kanji character. However, an unknown Kanji character is too difficult for Japanese beginners to look up, as they do not know its stroke count or pronunciation or radical. Some Kanji search systems utilizing hand-written recognition on PDAs or in other electronic forms may be found, but they are all designed for Japanese and the result depends greatly on the stroke order of the input data. Kanji characters are complex and it is difficult for Kanji beginners to write an unknown Kanji with the correct stroke order. No system could be found that allowed Japanese beginners to look up a Kanji easily. We have developed a multimedia Kanji dictionary with a search method that is friendly to Japanese beginners, utilizing hand-written recognition. Our dictionary can also show "mnemonics" in addition to the information found in a conventional dictionary. We have tested this system and obtained good results.

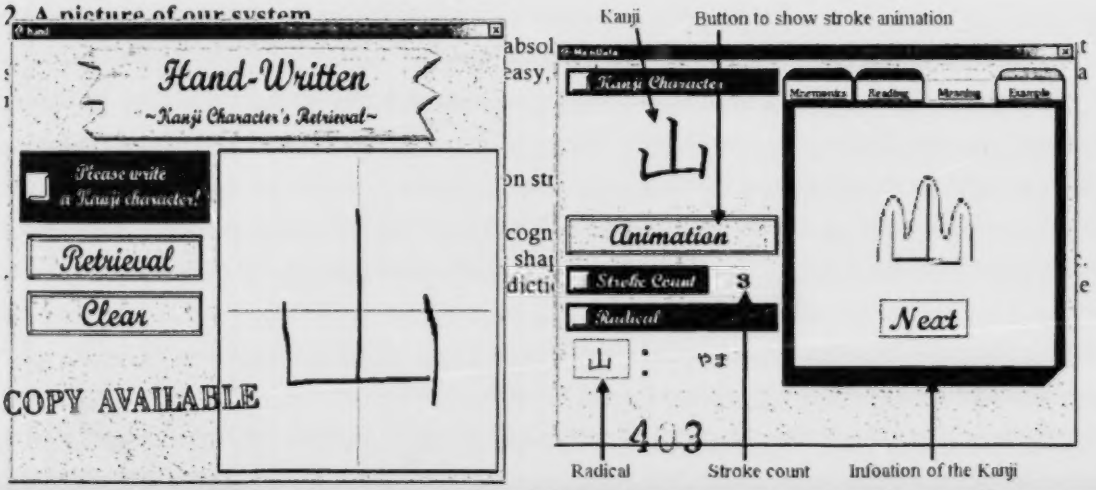
1. Introduction

It is much harder for Japanese beginners to use a Kanji dictionary than for English beginners to look up a word in an English dictionary. An English word can be found using knowledge of the 26 letters of the English alphabet and their order. However, to search for a Kanji character in a dictionary is not as simple. There are three keys for looking up a Kanji character. These are "reading", "number of strokes", and "radical (root)"; they are all too hard for Japanese beginners to know.

This paper proposes a multimedia dictionary suitable for Japanese beginners, by utilizing handwriting recognition. Microsoft IME (included in Japanese versions of Microsoft Windows operating system) has a function similar to our goal. A search for an unknown Kanji is initiated by dragging the mouse. However, it is dependent on the stroke order. For example, many foreigners recognize the character '口' (a mouth) as square at first glance, yet it takes 3 strokes when written correctly, and Microsoft IME cannot show the correct Kanji if it was written as one stroke. Other systems used on PDAs localized to Japanese have the same weakness.

There are some online systems available for looking up unfamiliar Kanji characters but we cannot find any system that is friendly to absolute beginners.

2. A picture of our system



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Kanji. The system shows "Reading" (On-reading and Kun-reading), "stroke count", "mnemonic", "stroke order animation", and "example usage".

3. Test use and its result

This system has been developed for self-learning. We obtained an evaluation from twelve foreign students at Waseda University. The foreign students used this system freely for about 20 minutes. We obtained an evaluation by means of a five-level questionnaire. The results were as follows:

Question	Avarage
Q1. Is this system useful for looking up Kanji?	3.75
Q2. Is this retrieval system easy?	4.17
Q3. Is this dictionary system useful for mastering Kanji?	3.67
Q4. Do you want to use this dictionary in the future?	3.67
Q5. Please evaluate this multimedia Kanji dictionary system.	3.50

Question 6. What are the good points and the bad points of this dictionary system?

Good Points	Bad Points
Many methods of searching	Too slow for looking up
Pronunciations available	Sometimes I cannot get what I wrote
Easy to use	303 Kanji is not enough
Nice to see	Difficult to write Kanji with a mouse
Searching by handwriting is useful	
Showing examples by sentences not by words	

4. References

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2: Shinichi FUJITA, Kazuto YAMADA, ChunChen Lin, Seinosuke NARITA, "The Application for Hand-written Recognition in order to Search on Electric KANJI Dictionaries for Non-Japanese Learners", ED-MEDIA 2001

Course Management Systems

While some argue that distance learning has been in existence since Biblical times (Gabrielle, 1997), it first gained notoriety in 1969 with correspondence courses offered at the British Open University. Since then, courses have been delivered via television, radio, and every other medium imaginable. Today with the advent of the Internet, institutions and organizations are putting their courses online at unprecedented rates. In today's era of web-based instruction in education and training, course management systems (CMS), also called learning management systems, can enhance or hinder the teaching/ learning experience. Organizations are increasingly evaluating CMS software for specifications and pricing when making purchasing decisions. This is problematic because 1) CMS technology changes frequently 2) organizations do not often know what specifications are needed, and 3) existing comparisons are often outdated.

This study examined existing literature to create a list of specifications that should be considered when making decisions about CMS. These specifications included approximately one hundred components comparing course learning tools, course collaboration tools, course development/ authoring tools, and course management tools. The specifications arose not only from literature about CMS products, but also from research on web-based learning.

In addition to the specification analysis, among four of the products, costs were compared (as of July 2001). Dialogue and follow-up with the CMS vendors provided clarification and further insight concerning product development and issues. Based on this careful analysis, the Florida Department of Revenue recommended one of the products compared.

To clarify, this study is not intended to provide a specific recommendation for a CMS product. Instead, it is intended to show which variables should be taken into account when making such decisions. The technology is a tool for achieving whatever tasks are proposed; therefore specifications are necessary considerations before determining which tool best suits the needs of the organization.

Background

Traditional classrooms have used the objectivist approach to learning based on Skinner's theory of transfer of knowledge from the instructor to the learner (Hazari, 1998). Recently there has been an epistemological shift rejecting traditional approaches about learning in favor of constructivist and similar beliefs. Web-based learning is best suited to the constructivist approach. Learning has traditionally been defined as an observable change in behavior. However, this definition is inadequate because in addition to examining learner performance, we must also look at the social and cultural context in which learning occurs as well as the tools that learners utilize to construct meaning (Jonassen 2000, Wenger 1998).

There have been tremendous shifts in pedagogical paradigms to a learner-centered environment that includes authentic instruction and flourishing communities of practice. Integrating activity theory with ecological psychology, Jonassen (2000) defines meaningful learning as, "a willful, intentional, active, conscious, constructive, and socially mediated practice that includes reciprocal intention action—reflection activities". After articulating an intention and acting on it, people then learn from reflecting on their actions in terms of their intentions. These points are critical when taking into account an environment that not only benefits the educational system but also must enhance the teaching/learning process.

Integrating Sound Instructional Design to CMS Products

Extensive research has shown that the integration of sound instructional design and motivational strategies enhance learning and performance (Song and Keller, 2001). Keller (1999) presents three challenges with web-based instruction: (1) learning environment design, (2) student support, and (3) the development and support of students' self-motivation.

The first challenge, learning environment design, deals specifically with features that should be considered when choosing a course management system. This is where the design should allow ample opportunities for interactivity, practice, and feedback. Learning environments that simulate the actual process in as realistic a manner as possible are preferable. Some CMS products excel in this area while others fall short. In the most basic form of communication in this context and others, there is a sender, receiver, and message. "If this message is intended as instruction, then besides student, teacher, and content, we must also consider the environment in which this educational communication occurs -- an environment that benefits the educational system in some ways and constrains it in others" (Berge 2000). The goal of a CMS product should be to benefit the learning environment. Specifications that should be considered include interface issues, interactivity, synchronous and asynchronous discussion options, and virtual document libraries.

One factor that has consistently been significant in research on distance learning is the need for interactivity with learning environment design. Since the advent of the Internet, capabilities for rich interaction have grown at previously unimaginable rates. However, simply because the capability exists does not mean that it is being integrated in an instructionally sound manner. Sometimes in a web-based environment, designers incorporate animation and exercises through products such as Authorware that serve more to show the abilities of the designers and the technology rather than to present challenging, engaging, and enriching activities that help develop necessary skills. Web-based learning has the inherent ability to allow learners to work at their own pace and their own convenience. It also has the ability to provide these rich opportunities with task related simulations, practice, and customized feedback. It is the designer's responsibility to ensure that these capabilities are integrated to their full potential while effectively enhancing the learning process. CMS products that allow streaming video and multimedia capability, customizable navigation buttons, and rich but customizable templates are best suited for these interactive elements. This includes the need for access to the code so instructional web designers can fully customize the products to best suit the needs of the learning environment. Therefore, though most products do not allow for this, access to the code is imperative.

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Likewise, the second challenge of learner support is critical. Studies are increasingly addressing the issue of social and cultural context in distance learning environments where student isolation and attrition have always been issues. Florida State University's use of a mentor-supported system through the 2+2 program (Hayes 2000) has shown immense promise in increasing completion rates from the traditionally less than 50% level to greater than 90%. Particularly with web-based instruction, it is important to consider the ratio of students to the instructor or tutor. It is not feasible to provide a course without support that must include issues of technology in this context. Some CMS products provide a rich context for learner support, including the capabilities of online mentors, live chat, and opportunities for learner collaboration.

Finally, the challenge of developing and supporting students' self-motivation has been addressed. Recently there has been promising research with regard to how to decrease student dropout rates, particularly through student support and motivation. Visser (1998) used motivational messages to establish a personal connection with students, increasing their confidence in the ability to complete the course while also increasing their satisfaction through the exchanges. Her study showed an increase in retention rates to 70-80%. The study also showed that there was a significant difference whether the messages were customized or sent en masse. This research is promising because while Visser used the postal system to deliver the messages, some CMS products enable automatic email reminders and customized messages to address this issue. Other issues of self-efficacy and self-regulation with regard to CMS products include allowing students to access their own grades, to track their progress, and to have the capability for integrated online notes.

In conclusion, this paper examined a number of instructional design considerations as they relate to course management systems. These considerations include the incorporation of sound instructional design to encourage active learning, opportunities for practice with immediate feedback, and rich dialogue between instructors, learners, and outside experts. From the perspective of interface, the importance of the opportunity to customize all features of the course management system was addressed. Learning environment design issues such as this are critical to enhancing learning, performance, and retention in web-based environments. Finally, the integration of learner support and the ability to enhance student self-regulation and self-efficacy was discussed in the context of CMS. These findings shed light on what specifications should be addressed when considering CMS products.

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Motivation and Distance Learning

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There has been an epistemological shift rejecting traditional approaches about learning in favor of constructivist and similar beliefs. As this study shows, the shift is especially evident in distance education. Applying Keller's ARCS model, my research focused on what specific kinds of feedback, evaluation, and practice are most effective (or appropriate) to enhancing motivation in a technology-mediated environment. Satisfaction levels with online learning were also examined. This initial collection of quantitative data (including open-ended questions) via questionnaires revealed several patterns that led to follow-up and collection of qualitative data. The qualitative information was coded in terms of frustration, motivation, interactivity, and transfer of skills. The results confirmed that when online learners are motivated or respond positively to the online training, they perceive that there is a greater transfer of skills to their jobs. Likewise, when learners lack the confidence to succeed in an online course, the end result is frustration with little or no transfer of skills. The intention was to shed light on how people responded to the online training, both positively and negatively. Some of the most revealing information came from those learners who were frustrated with the experience. Motivational tactics are essential to the success of technology-mediated courses.

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What we Learned from A User Survey: Selected Results for Digital Television and Internet Planning

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A survey conducted by Brigham Young University's nationwide channel, BYU-TV, discovered substantial interest in taking distance learning courses offered over that channel and through internet communication. The group responding was somewhat older, more female and more professional than what was expected. Survey research using both the web and mail-out surveys require attention to detail and more steps in the questionnaire creation process.

TEACHER PROFESSIONAL DEVELOPMENT BY MEANS OF INTERACTIVE VIDEO-CASE STUDIES: WHAT RESEARCH QUESTIONS SHOULD WE FOCUS ON?

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ABSTRACT

The Internet has created many opportunities for lifelong learning. It opens a worldwide window for students, parents, educators and workers. However, for solving the problem of keeping large numbers of educators up to date in their field, giving everyone Internet access is not sufficient. Relevant educational programs must be provided – programs that are closely integrated with the educational setting and that address major challenges. One such challenge stems from the necessity to adhere to national and regional standards in different content fields. Educators are required to keep pace with advances in their disciplines, while improving their performance by integrating desirable content, processes, and technology into standards-based curricular materials.

School districts face a critical challenge in providing their educators with pertinent and significant professional development opportunities. Summer courses, weekly or biweekly seminars, and participation in conferences can provide such opportunities for many teachers, but conventional face-to-face professional development programs cannot meet the demand for continuing education of all teachers. Information and communication technologies have created new means for sharing information and experiences, as well as for building learning communities of teachers, administrators and teacher professional developers. But despite networked schools districts, cheaper Internet costs, and more computer literate teachers, there is still no systematic means of providing interactive professional development.

The Seeing Math Telecommunications Project[1] offers a strategic response to this problem by adding value to an existing offering. Seeing Math focuses on helping math teachers become acquainted with the NCTM 2000 standards by offering them the opportunity to reflect and construct knowledge around interactive video case studies that are explored online. Video clips and support materials, flexibly structured as a series of individual "chapters," are used to show experienced math teachers constructively interacting with their students in normal classroom settings. Threaded asynchronous discussions help the participants to analyze and build knowledge around each case study.

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[1] See http://www.concord.org projects: The Seeing Math Telecommunications Project

Local implementation and community sharing of experiences help to foster systemic change in the participating school districts. As the leader of this initiative, the Concord Consortium is conducting research concerning this new, highly interactive online learning environment.

The arrival of this new kind of open-ended, powerful learning environment poses new questions for research into teacher professional development. What should be the focus of the research? Is it simply a matter of comparing this new highly interactive video case study approach (and whatever variations we may choose to make to it) to more conventional treatments on basis of effectiveness and cost? Or does the use of the new technology really raise new questions, and offer an opportunity for more systemic educational change? These and other provocative questions will be addressed in the format of a free-ranging discussion group.

ABCs and XML: How Semiotic Search Engines Can Mine "Diamonds" of Information on the Internet

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Abstract:
XML is demonstrating that the evolution from HTML to XML allows semiotic tools to be included in software program designs. This can dramatically change the nature of Internet programming because the use of symbols, graphic objects, audio, proxemics, or virtual reality programs, will introduce nonlinear dynamics to mediate with HTML and cognition. Metaphoric programming, a symbolic method of delivery of information has not been used with HTML. But research has shown that cultural content from symbols demonstrates the rich meaning and communication cultural systems. Instead of Boolean searches currently used by most search engines on the Internet, an XML-based semiotic search engine could allow for semiotic searches to build upon those cultural systems by including symbol searches and bring a whole new dimension to knowledge acquisition through the Internet.

From the Phoenician merchants' recordings of commodities five thousand years ago emerged text and printed cuneiform tablets. Guttenberg's printing press gave serfs access to information and communication. Twentieth century radio, movies, and television brought a new awareness and ability to communicate to people all over the world. Over the last thirty years computers have integrated all these prior media forms and introduced a global interactivity. The newest innovation, XML, integrates all of those communication forms into a virtual realm that can include semiotic representations to help acquire and share communication and information in a number of ways.

XML is demonstrating that the evolution from HTML to XML will change Internet programming by allowing semiotic tools to be included in software program designs. This can dramatically change the nature of Internet programming because the use of symbols, graphic objects, audio, proxemics, or virtual reality programs, will introduce nonlinear dynamics to mediate with HTML and cognition. The results of the synthesis will be a new dimension of meaning conveyance in communication.

Currently HTML provides tags to define the parameters of coding, what coding will be placed on a webpage, as well as where and how that coding will be placed on a webpage. The advantages of XML over HTML are demonstrated when XML's coding provides for more than the basic coding provisions of content positioning. XML has the ability to distinguish and incorporate semiotic representations into its program and hence provides a new dimension of recognition in software programming.

XML allows tags to be defined for a webpage document that can created to be read in ways unprecedented in other software languages like HTML. For example, XML can incorporate symbols or even musical signs as part of the data definition. The XML tags can also be created to direct the program to analyzed data, sent data to a database, put data in a spreadsheet, etc.

Semiotics is the study of patterned human communication behavior, including auditory/vocabulary, facial expressions, body talk, touch (proxemics), signs, and symbols (Webster, 1989). As sociocultural tools, the signs and symbols, etc., included in semiotics, take on enriched meaning, affecting the functions of human consciousness as well as their environment. Ultimately, everyday language and discourse come under the scrutiny of this discipline since it becomes a metalinguistic descriptor of ordinary communication (Dant, 1991). Ordinary language identifies and uses written material and verbiage to communicate and express meaning. Language also uses these "tools" to construct meaning and, in some psychological schools of thought, i.e., the structuralist school of thought, these tools are analyzed in order to study the social context of language in a meaningful way.

Levi-Strauss took this analysis one step further, incorporating more intimate terminology. He stated "kinship terms are elements of meaning...(however) they acquire meaning only if they are integrated into systems (1970)." He posited that if forms are recognized as the same for both ancient and modern minds, as the study of the symbolic functions indicates, the unconscious structure underlying customs and institutions need to be studied to "obtain a principle of valid interpretation" generically applicable across cultures (Dant, 1991). There are semioticians who research the "insignificant" semiotics of every day symbolic representations that are laden with meaning and social significance (1991). These "insignificant" phenomena often contain inspired rich meanings that fill in the gaps of information and help define cultural, and, in particular, sociocultural, trends (GannonCook, 1998; Wertsch, 1985).

The semiotic aspect of XML is a quantum leap beyond HTML that is limited to text because with XML's ability to recognize these symbols, the software program takes a big step beyond basic program commands. What this means to the field of programming and Computer Science is that a whole new synthesis of communication tools is now possible. The communication bar is raised because XML reduces the need for extraneous programming.

In the field of semiotics, "metaphoric programming" is simply a symbolic method of delivery of information. But research has shown that "a cultural content emerges (from symbols) in the development of cultural systems (del Rio & Alvarez, 1995). Instead of Boolean searches currently used by most search engines on the Internet, an XML-based semiotic search engine could allow for semiotic searches. For example, searches could be conducted for specified data, inscriptions, and even music symbols. This would enable searches to be much more intuitive, and could distill searches to hone in on more appropriate and condensed search results. XML could offer an alternative to the current information inundation that engulfs Boolean searchers and provide electronic parceling of data in ways that have not been available until its inception. Tools like XML that mediate between human consciousness and computers could provide a safety zone where new blueprints could be drawn for both. Symbols and metaphors that render the process of meaning possible could be particularly useful.

There is an old adage that "the one thing we can always count on is change." While we know change will occur, we still hold on to memories and bits of nostalgia that give meaning to our lives. In the past, books conveyed information with text and pictures; television conveyed text, pictures, and sounds; and computers combined books & media with sound and real-time interactive communication. The promise of XML is not just to win the search engine hunt for information, but to win the hunt with the trophy of meaningful and relevant results.

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Teacher Candidates and Mentor Educators: Integrating Aspects of a World Wide Web Site into a Developing Lesson Plan

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The World Wide Web (Web) holds numerous possibilities for all learning environments, from the very young to the older learner. Teacher candidates and mentor educators focus their expertise upon the design and development of lesson plans that are appropriate for their classroom learning environments. Through the introduction of technology, namely the World Wide Web, educators are having a philosophical shift in thinking take place. The teacher candidates and mentor educators have emphasized the successful and appropriate integration of designing and developing World Wide Web sites into their lesson plans. The educator has the opportunity to not only design and develop their own Web sites but, once the learners are sufficiently experienced at the Web site development, they may begin development of Web-based aspects that will enhance the active learning environment and the emphasis upon higher order thinking skills.

Constructivism in Web Based Learning Revisited: Explorers with a Machete in a Hypermedia Rain Forest

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Abstract: Nowadays, e-learning is booming: thousands of online courses and dozens of universities online. However... Quantity has little to do with "real innovation". In very rare occasions, online courses and teaching institutions are breaking with the rules of the Gutenberg Galaxy. They are designed on a linear basis, and based on conventional text. What if we try to put state-of-the-art technology aside for a while? What if we try to think exclusively in terms of cognitive efficacy? Then we will be able to create non-dependent on technology models for teaching online. We've done so, and developed our *"Full-Hypermedia Educational Systems Development Model"*, which intends to take full advantage (in terms of cognition and learning) of non-linear navigable structures and multimedia. We want to have our students exploring a rich, hypermedia environment. We want them to face the problem of finding their own way in the middle of (only apparent) chaos.

Introduction: Fun Fairs and Real Rain Forests

Nowadays, Internet is packed with good online courses. Thousands of them. Some include additional navigational aids, interactive exercises, simulations and links to other websites of interest; the best even add tests and a virtual notepad and student tracking facilities. Probably they will do wide use of e-mail and discussion forums. But in the end the structure is always the same: linear. There are plenty of examples of very good courses that lack one only thing: breaking with the traditions of Gutenberg Galaxy.

Most of the courses one comes across in the Web are, in some way, like fun fair's stalls: a very restricted and controlled environment where the student has no option but clicking now and then the "next page button". They are just a "safe" imitation of "real" hypermedia. All in all, perhaps it's about time to take advantage of the cognitive potentials of exploratory navigation in hypermedia networks. In practice, we mean, not only in theory. That was our aim when we begun to develop our *"Full-Hypermedia Educational Systems Development Model"* (FHESDM).

We situate the learner in a real rain forest (not a jungle: it makes no sense to build completely chaotic systems), instead of a fake. We want him to struggle in order to find a way. His way. We want to transform navigation (though it may sound bizarre) into a problematic situation. One the kind Jean Piaget proposes as generators of new cognitive structures development. Our aim? To make students construct their own knowledge. But not from social interaction and collaborative learning, the nowadays most common implementation of constructivist principles in Internet. That's undoubtedly a very good philosophy but... we felt like trying another approach. We wanted to focus in cognitive constructivism, based on the "blind" exploration of a rich hypermedia domain.

Imagine an explorer that, with a machete in his hand, wanders around an unknown for him rain forest. No map. Just never-ending vegetation. Obviously, while he walks he'll begin to build a mental map (a deformed one, for sure) of the place: rivers, openings, trees types, animals,... will allow the explorer to imagine a structure of the place, based on his own and personal way of moving and on the "designed in advance" structure of the rain forest (remember: our course won't be chaotic, being its structure very carefully thought). When eventually he gets a high enough hill, he'll be able to watch the whole rain forest, and realize the mistakes in his mental map. He'll locate the places he knows yet, and then will locate new ones. But above all he will have the chance to discover the real relationships between the locations. After all this "correcting work", he'll go down again, and have the chance to pay more attention to specific details, his knowledge of the information space completed now.

After the whole process, something is for sure: our explorer has got to know the rain forest very well.

Making Your Way in the Middle of the Woods

As we've mentioned previously, our model is based on constructivist principles (see Larios 98). Specifically:

- Subjectivity of the learning process: The student must explore the system according to his own interests. That way he will construct his own mental schema. The differential feature in our model (right the opposite to other approaches, like that of Ausubel and Novak's (Novak 01)) is that we'll provide no map to the brave explorer: he must recreate the structure from scratch. He must navigate the structure "from inside" before contemplating the whole view.
- This "blind exploration" will involve a problematic situation for the student, who, by solving it, will advance his "knowledge creating process" (assimilation and accommodation).

But constructivism isn't the only milestone of our model. We've adopted (and adapted) some aspects of Ausubel's Significant Learning Theory (Ausubel 68) too. For instance, the information structure of the courses will present first the most general ideas, providing more details as the learner moves on to deeper levels in the structure. We'll also use the idea that any new knowledge to be learnt must be attached to previous known concepts, already in the student's cognitive structures.

Some way, we want to offer the user a rich context where to play his own and personalized role (see Ascott 99), developing his own cognitive structures and augmenting, at the same time, the "incidental knowledge" (Lee 99). Our aim is to get it without eliminating narrative (Laurillard 98) and without making "cognitive overload" explode (see Plowman 99 and Lee 99). In this section we'll refer to the "Structural Dimension of Hypermedia", specifically: those aspects related to the information structure and the navigation structure. In a sense, we'll be trying to convey Structural Knowledge to the learner.

Thus, the structure of the system must be designed with an only purpose in mind: conveying a structure of knowledge. Certainly, our approach inherits the philosophy of Novak's Concept Maps (Novak 01), differing from them in two basic aspects: we propose a more methodical (and somewhat rigid) design of the network (in order to minimize the problems described in the previous paragraph), and we avoid showing an "aerial view" of the system to the student. If learning by discovery and exploration is a milestone in our model, the aid of a map from the very beginning may encourage an exploration of the woods as a whole, not of every tree and its relationship with the rest. We want an inmersive course, no a landscape to explore.

We begin the design by creating a hierarchy of layers, in which any node is a summary of all the nodes that "hang" on it. That way, penetrating into the lower layers in the hierarchy means to obtain more details of previously revised concepts (remember Ausubel's proposals). On the other hand, going back towards the root of the hierarchy allows the student to see the knowledge space from a more holistic point of view.

Once we have developed a hierarchical space of contents, it's about time to establish the necessary relationships between pairs or pages (or, more generally, nodes). In an effort to keep a sense of modularity in the course, during these first steps in the design process we'll limit to set links between nodes situated in the

same sublayer, i.e., nodes sharing the same father. That way we'll be creating small navigational subspaces, whose "gate" will be the father node.

Up to now, the proposed model looks fine, but there is little special, little different on it. This is a most suitable time to introduce a new element in our model: the "contract" concept. Thanks to it, we'll be able to superimpose several navigation structures upon an only information structure, allowing for a more customizable way of navigating through the system without using Intelligent Tutoring Systems (i.e., without taking the control out from the hands of the student, a fundamental constructivist idea).

Actually, contracts are a concept inherited from the Object Oriented Design and Programming world. For us, contracts will be the different sets of links a node can show to the student, depending on the path followed to get there. That way, an only node of contents can be inserted into several navigation structures, that's to say, into several ways of conceiving the knowledge space, all in the same hypermedia system (Fig. 1).

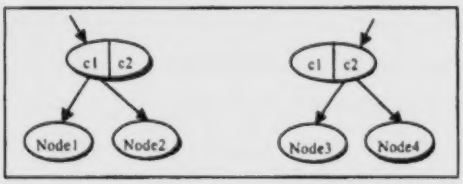

Figure 1: Node with two contracts.

So Blue the Rivers, so Green the Trees

Other important kind of knowledge a course has to convey is Declarative Knowledge. The nowadays way of doing so online, most of the times, is by means of text and graphics. We intend to situate our learner in the middle of a colorful rain forest. We'll try to take full advantage of multimedia, in order to complement exploratory learning. It's what we call the "Exposition Dimension" of hypermedia.

We like to consider multimedia as the third dimension of hypermedia: a set of vectors, each associated to a node in the two-dimensional network.

A vector represents the amount of multimedia information displayed by a node, and, of course, the way in which that information is displayed. We'll dedicate the rest of this section to justify and describe the way in which our FHESDM copes with this vectors, intending always to keep on the track of constructivism and cognitive efficacy: what we have so called the "docuscheme", a cognitively sound model to present education oriented multimedia information.

Reading on a screen is annoying and frustrating. People read on books and magazines, but nobody would be willing to read on a TV set, for instance. Screens are the land of pictures and animations, not of written words.

Let's use pictures then but... what kind of pictures? Well, static ones, preferably (animated pictures are too "volatile"), and shocking to the perceptive system of the student (this will encourage attention and retention, as mentioned by (Trumbo 98)). Any other feature? Yes, indeed. It seems interesting to provide a summary of the node's contents: let's employ an only picture then, captivating and eye-catching to the student, but at the same time behaving as a big and high level scheme of the node's contents. An "advance organizer", in Ausubel's terminology.

And then... What else? We want to convey contents, not just a scheme of the contents. We need a way to put a large amount of information inside our fashionable node. One interesting possibility is audio. Audio is always a powerful communication resource (see McKillop 98). What's more: by introducing oral narration in

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our system, we are combining static picture with documentaries' principles. We are getting closer to the concept of "Docuscheme", now.

In order to get even closer, and to increase in an ultimate way the "information capacity" of our node, we could think of explaining every concept in the scheme by means of some kind of video, animation or whatever multimedia element the designer considers appropriate.

So now we have a big, colorful graphical scheme, explained by means of audio and acting as an umbrella that covers an enormous amount of multimedia information. It sounds fine: a node as catching as a documentary and as accurate as a textbook. It only lacks a few complementary elements more.

First, accessing the information in a node in a film-like way (not in vain we are trying to imitate television documentaries in some way), i.e., from the beginning to the end without interruptions, may be fine for the first viewing, but not for the next visits to the node. Consequently, each part or the scheme must be accessible separately, once the student is inside the node.

Second, perhaps we mustn't eliminate completely the text. Perhaps reading a textual version of the contents after viewing the full multimedia presentation may be a great opportunity for the student to analyze in full detail the information, to impose the student's information acquisition pace on the prefixed pace of video and audio. We must admit the text back in our system then, but only as a secondary element, a post-viewing resource.

Making the Most of Your Machete

Daily life in the rain forest is no at all contemplative. On the contrary, you must be continuously moving, and doing and achieving in order to survive. Well, our situation is somewhat better but... we shouldn't forget "surviving by doing", anyway. In this case, learning by doing. ¡We need to include opportunities for strong interaction in our web courses! Our model still lacks the third kind of knowledge: Procedural Knowledge.

"Learning by doing" complements the "learning by exploring" and the "learning by watching" approaches used up to now (see Scott 00). And the most common way to implement learning by doing in an online system is interactivity. But we mean real, full interactivity, not just navigating. What's more, we propose to separate very clearly interactive activities from the rest, more passive ones. That way, we reduce fragmentation, as we are not interrupting expositions of declarative knowledge.

In order to satisfy the interactivity (more precisely, the "separated interactivity") requirements of the course, we have created the concept of "satellite". Satellites are complementary nodes that "orbit around" a declarative node (see the reason for their name?). Every satellite contains an interactive activity of any kind (exercises, tests, simulations, real examples, study cases...) (Fig.2).

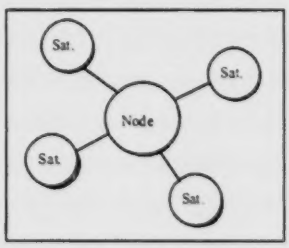

Figure 2: A node and its satellites.

Any question about the design of satellites? Oh, fine. Unfortunately, we don't have any answer. Each satellite depends strongly on the declarative contents it intends to complement, the available resources, the designer's objectives, etc. Anyway, if you want a hint, we recommend not to display the satellite in the same

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window you are displaying the declarative node, but in a smaller, detached one: that way the context in which the activity is being realized will be before the eyes of the student constantly.

Welcome to Our Virtual Rain Forest

Though our intention was to develop a model beyond temporary technology restrictions, it seems somewhat important to introduce a real implementation of the model, in order to show that we are describing a feasible way of creating online courses, that creating that sort of rain forest is not a dream. We'll explain the technological items we are using for the time being, but keeping always in mind that, in all probability, they'll change very often in the future.

The aim of our implementation is to develop a core of navigational aids easily adaptable to any set of HTML documents. That way, once you have the contents of the course (a set of multimedia web pages), you just need to superimpose on them the core of tools previously developed to have the system running.

These tools have been built using typical Internet programming resources: DHTML for the user interface, Java Servlets for navigation control and user tracking, and XML for data representation (Fig. 3).

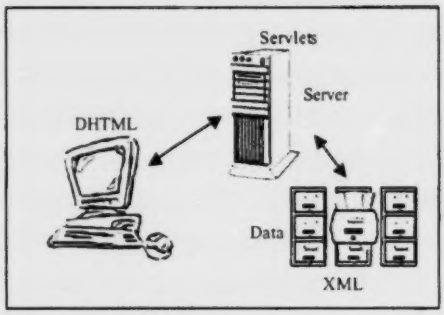

Figure 3: Nowadays implementation of the model.

This is a graceful way to implement the Structural Dimension. What about the Exposition Dimension? We are currently evaluating some options. Specifically, we are considering Java Applets, XML (SMIL, more specifically) with DHTML, and Macromedia Director or Flash. Though there is no definitive conclusion yet, for the time being we are using Macromedia software. The reason for this can be summed up with an only word: simplicity. The design process our model involves is rather complex, and it doesn't seem a good idea to increase the complexity even more.

There is also the problem of bandwidth. Although it's increasing very quickly, this remains the main obstacle to take full advantage of docuscheme principles over Internet. In the meanwhile, vector's graphics and streaming techniques are a good option.

Anyway, we are looking for a personalized solution, as we don't think appropriate to depend on proprietary applications. Specifically, we are trying to combine Java applets with SMIL data representation, in order to create our perfectly customized "docuscheme's viewer".

Conclusions and Future Work

When we begun our research a few years ago, we undertook two premises: first, we intended to obtain something not depending on temporary technology; second, we wished to "make the difference significant", paraphrasing the famous "The Non-Significant Difference Phenomenon" website.

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We accomplished the first by developing an abstract model. In our opinion, that's the only way to walk ahead technology, and not always behind. If we concentrate exclusively on applying the state-of-the-art technology, we'll never be able to move fast enough: technology will always be faster, and bringing some kind of stability to online learning will always be a dream impossible to get into practice. Abstract models, based on pedagogical and cognitive principles, give us the chance to "take over control" of the situation. We'll ask technology for what we need, not the opposite.

The second premise is reflected in the kind of model we have created. If we put real technology aside, at least for a while, we can think in a "riskier" way. We can think of instructional systems' features different from the habitual. In a word, we can work with features that help us to transform the use of online learning into a really significant difference. We've tried to reach that point breaking with linearity and text, and making extensive use of exploration and multimedia. In a word: developing our own way of applying constructivist principles to Web Based Learning.

And next? A mountain of research and development is still to be done. The path is long, and we've just begun to walk. From an abstract point of view, we are eager to keep on improving our model, realizing new experiments, and making up new ways to obtain full advantage of the Web. And what about a more technological point of view? Well, the design process in our model, as it has been described here, involves a very complicated sequence of stages, and requires an immense amount of work. So we are planning the development of a software tool specially thought to make design work far easier and convenient, eliminating routine tasks and facilitating collaborative design.

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Construction of User Model via Psychological Assessment: Work in Progress

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Abstract: The paper discusses user-centered approach to adaptive Web-based tutoring in 2 aspects: construction of psychological profile of the user and adaptive interface design. The development is based on the concept of user model that is a formal description of user's characteristics such as left/right hemisphere asymmetry, perso nal features, preferences, cognitive style. This user model is initially obtained through the preliminary testing by special intelligent software environment TRIVIUM which contains special knowledge base for psychological assessment. Information in this model is applied for defining a particular educational program for each user and specialized interface design.

Keywords: User model, adaptive hypermedia, web-based tutoring, distance learning, human-computer interaction

Introduction

The paper discusses psychological aspects of the user-oriented interface design and a research framework for acquisition of user models in a form suitable for later automated use in adaptive applications, including distance learning systems on the Internet. The study of user modeling for a wide range of is continued in the current paper towards the practical estimation of psychological and other numerical parameters, with which a program with adaptive interface could automatically adjust itself to formally measured characteristics of its user.

Available literature on user modeling (see [Self, 1974; Self, 1994; Stefanuk, 1976; Wagner, 1992] for few though representative examples) reveals two opposite approaches to account for user's peculiarities in human-computer interaction (HCI). First, one would try to describe «analytically» possible groups of users of a given computer/software environment and to map explicitly their essential characteristics to the appropriate tunable interface parameters. Second, one would treat the problem in a manner similar to machine learning, neural networks etc., when a program automatically adapts to its dynamically changing environment through a kind of feedback loop. The latter, «empirical» approach may be considered as dominating nowadays in view of rapidly developing multi-agent technologies and distributed computing. It is evident that for multi-agent systems, where the program–program interaction is as important as the program–user one, such empirical modeling of «environment» is preferable.

We may give the following definition to the concept of user model: notions of the system about the user, that are based on a priory information and direct interaction between the user and system. This model presents a formal description of user's characteristics such as left/right hemisphere asymmetry, personal features, preferences, cognitive style. Usually the main attention is given to professional preparation of the user and level of his computer competence but humanitarian aspects are not taken into consideration. However, taking into consideration both psychological and professional user's peculiarities allows to minimize intellectual efforts of the user necessary for understanding system's actions in the process of exploitation and reactions on it.

TRIVIUM (first version was developed by Voinov [Gavrilova, Averbukh, Voinov, 1996]) is a tool that was implemented for acquiring user models. Its present version was developed jointly with Timothey Geleverya in the Intelligent Systems Laboratory of the Institute for High Performance Computing and Databases (http://www.csa.ru/ailab). It puts stress on psychological parameters of user model as the most important among those affecting HCI.

Psychological factors

One can group factors, which affect the user's productivity, into several classes. Within each class only those factors, which allow for a more or less formal estimation, are emphasized. They can be classified differently by different authors. For example, one could emphasize two dominant (though probably overlapping) strata: emotionally-communicative and cognitive ones.

The first stratum deals with the area of interaction between the user and the computer and comprises the problems of *perception, understanding, clarity, usability, handiness* together with some other features. The problem is how to gain the user's sympathy and confidence, taking into account the temper and intelligent peculiarities. In this way, [Kearsley, 1997] stresses the problem of *anxiety* in educational systems, which can be an inhibiting factor in learning and therefore has received considerable attention. It is closely related to *arousal, attention* and *motivation* as well as the entire topic of emotions.

Anxiety can be reduced in an instructional context by:

- Instructions that minimize stress and prepare individual;
- Increased use of positive feedback during a task;
- Reduced opportunities for failure in a task.

The *cognitive* stratum comprises deeper problems related to human mind and memory. Often novices feel the cognitive dissonance between his/her expectations and the interface layout and behavior.

An extremely important factor is *personal cognitive style* [Witkin, Goodenough, 1981], which considerably influences the problem solving way. Kearsley [Kearsley, 1997] lists a number of cognitive styles that have been identified and studied over the years. Such characteristics of individual cognitive styles may be assessed and taken into consideration: field independence, scanning, leveling versus sharpening, reflection, conceptual differentiation.

A similar taxonomy may be introduced among characteristic styles of learning. Theoretically, *cognitive and learning* styles could be used to predict what kind of instructional strategies or methods would be most effective for a given individual and learning task.

The style of logical mentality or deductive/inductive strategies is also important. In case of deduction users perform their cognitive activity via top-down strategy from the higher level of abstraction to more detailed schema. On the contrary, in case of induction the users ascend from the unconnected elementary concepts to meta-concepts. Cognitive modelling should also take into consideration the role of cerebral asymmetry. The left hemisphere forms a model in which the elements and their organization are analytical, sequential and "discrete". On the other hand, the right hemisphere cognitive style is holistic, Gestalt, analogous and mosaic.There is a vast continuum of intermediate RH/LH positions; nevertheless, most users can be subdivided into two correspondingly separated groups characterizing their cognitive and psycho-physiological type that is relevant for expert operational activity, choice of reasoning and processing strategies.

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The battery of tests implemented in TRIVIUM includes inventories on major part of the mentioned above parameters, including metaphoric thinking, syllogistic reasoning, different kinds of classifications and sorting, linguistic and reflective abilities.

Special Software Environment to Acquire User Models

TRI VIUM – is an intelligent software system for multi-factor quiz's data interpretation. It can work with all types of question-answer tests. TRIVIUM allows to present respondent's verbal portrait and profile according to the test results. It includes the following components (Figure 1):

1. Respondent's workplace. It has simple interface, because it is intended for non-programmer users.
2. Psychologist-expert's workplace presents interactive program that functions in 3 modes:
   - test development – psychologist is able to define a list of questions, variants of answers, list of scales that characterize test result and scheme of their calculation. The scheme of calculation is a table that defines conformity between the answer on each question and scales. At a choice of concrete variant of the answer all the scales on which it (variant of the answer) influences and also their increments are determined under this table.
   - Editing of knowledge base of the rules for test results interpretation.
   - Statistical data processing. Psychologist is able to get personal data for each respondent (name, gender, date of birth, time of testing), all his answers, set of calculated scale values and their verbal interpretation. Expert is able to enter comments for each respondent in this mode.
3. Information base containing rules for tests' results interpretation, quizzes' base, respondents' tests, personal data, users' profiles.
4. Fuzzy inference engine for automatic verbal interpretation of tests' and quizzes' results using rules, defined by psychologists-experts.

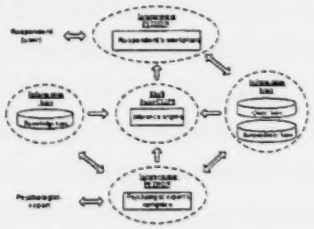

Figure 1.

Quizzes' results are analysed according to the following scheme.

Testing
↓
Factors in "raw values" (numerical values)
↓
Factors expressed in linguistic variables
↓
Entrance vector of factors
↓
Analysis of the entrance vector of factors in the inference engine
↓
Output vector of factors
↓
Translation of the linguistic variable of each factor into its verbal (textual) expression
↓
Text construction of the verbal portrait in dependence on availability of the groups joining the factors on semantic commonness

There are a lot of factors that influence upon the choice of special educational program for the user therefore to find an optimal one it is necessary to carry out a full psychological investigation of the user to get his psychological portrait, to provide comparison of his psychological peculiarities and educational program. For example, profound learning of the material would be difficult for the "novice" and he should be presented only part of the course with basic quest ions. If the user has some preliminary knowledge of the subject domain but wants to define some questions more precisely he should be given part of the material he is interested in. And the whole learning material should presented to the "professional". Therefore for correct defining of the user portrait it is necessary to use a balanced test system but not a single test.

At present Trivium tests' base includes the following quizzes:

1. 16 PF (Personality Factors) Cattell test that assesses the level of 16 personality traits in individuals 16 years and above.
   A reserved vs. outgoing
   B concrete thinking vs. abstract thinking
   C emotionally less stable vs. emotionally stable
   E accommodating vs. assertive
   F sober vs. enthusiastic
   G flexible vs. conscientious
   H shy vs. venturesome
   I tough-minded vs. tender-minded
   L trusting vs. sceptical
   M pragmatic vs. unconventional
   N forthright vs. astute
   O self-assured vs. apprehensive
   Q1 conservative vs. experimenting
   Q2 group-dependent vs. self-sufficient
   Q3 spontaneous vs. controlled
   Q4 relaxed vs. tense
   It measures levels of dominance, abstract thinking, anxiety, independence and control.
2. Test on locus control.
3. Personal scale of anxiety demonstration. It allows to assess common level of a person's anxiety. This assessment may be used for the construction of

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the so called "short-term" interface.

4. Callerman-Pluchek test.

User model is formed on the basis of these tests results. Screen forms are presented on the figures 2-4.

In this framework a special program was realised that can assess user attention. It allows to assess 2 parameters of the user - attention volume and concentration. Methodology that is put into the basis of testing is called "Proof test". The user is given 10 rows each one consisting of 20 letters and he has to pick out a letter in each row that coincides with the first letter within 30 seconds. As a result he is given a verbal and numerical assessment that is put into the user model. Knowledge of the user model parameters allows to choose corresponding interface for him. For example, if the user is scattered he should be given more help, the forms of interface objects should be changed.

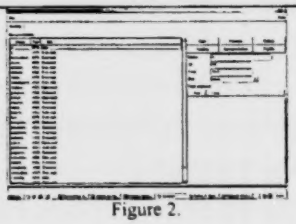

Figure 2.

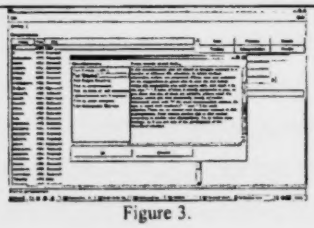

Figure 3.

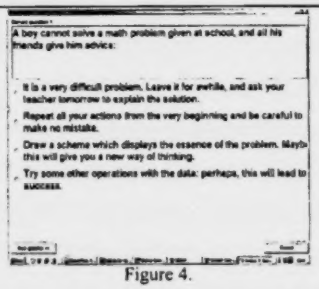
A boy cannot solve a math problem given at school, and all his friends give him advice:
It is a very difficult problem. Leave it for awhile, and ask your teacher tomorrow to explain the solution.
Repeat all your actions from the very beginning and be careful to make no mistake.
Draw a scheme which displays the essence of the problem. Maybe this will give you a new way of thinking.
Try some other operations with the data: perhaps, this will lead to success.

Figure 4.

System is prototyped in the framework of: Python scripting language, Tcl/Tk/Tix GUI toolkit, FuzzyCLIPS inference engine, original data processing library. It runs both under Unix and Win32 (Windows 95 and NT). Taking into consideration user's peculiarities the software developers may enhance usability, handiness and efficiency of interfaces.

Discussion

The work is now in progress. The approach and software described in this paper may be implemented for the design and building of adaptive interfaces embedded in different HCI applications. Taking into consideration user's peculiarities the software developers may enhance usability, handiness and efficiency of interfaces. A series of experiments for mapping of UM parameters onto interface parameters are now under examination using TRIVIUM environment. For further automation and adjustment of the resulting user models a set of specially designed intelligent *agents* is being developed aimed at controlling and monitoring users' activity during their active work or learning sessions. Variable parameters of the interface may be the following: form of presentation and format of input and output data, dialogue type, level of messages of auxiliary character, automatically set up parameters, set of necessary auxiliary commands.

Preferred method for navigation is a very important characteristic for the system design. For example, users who rated themselves as having difficulty navigating to specific areas were expected to benefit from a menu-based interface. Menu-based interfaces require less mental demand than other types of interfaces. Users who rated themselves as having no difficulty navigating through the system and wanted to quickly navigate were expected to benefit from an interface where menus could be skipped and shortcut keys could be used [Bushey, Mauney, Deelman, 1999].

Acknowledgements

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Evaluation of Online Educational Software Designed for the Purpose of Teaching Programming

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Abstract: In this paper we evaluate educational software, available in the market, designed for the purpose of teaching programming that addresses mainly beginners and intermediate students. The evaluation is conducted on the basis of an evaluation model built in University of Macedonia, Greece in the context of project "Odysseia" that is mainly designed to introduce computer and network technologies into the everyday school practice, especially in secondary education. The paper discusses briefly the project and introduces the educational software that was evaluated. Next, it presents the evaluation method and the processing of the data and finally reports some conclusions derived from the evaluation.

Introduction

The number of products from the educational software industry has significantly increased the last decade. The reason for that increase is closely related to the basic policy assumption that educational system should serve the overall target of 'information society for all' (see CEC 2000). Schools should prepare students to use actively new information and communication technologies (ICTs) taking advantage of the life-learning process that these technologies support. As a result in most countries all curriculums are under continuous development adopting ICTs in teaching and learning. In Greece the national curriculum is currently under reform, especially in secondary education, attempting to follow educational and technological advances. A number of projects come with this reform. One of the biggest in that respect is 'Odysseia' Program, which is part of the Ministry of National Education and Religious Affairs' Operational Program 'Educational and Initial Vocational Training' and is implemented by the Directorate of Studies for Secondary Education, the Directorate of the Community Support Framework, the Pedagogical Institute and the Computer Technology Institute, which are underwriting the design and technical support and monitoring the implementation of the 19 Projects that make up the Program. It is a dynamic, action-oriented program designed to cultivate and develop the faculty of critical

thinking and to change the practices of teaching, learning and communication in Greek schools through the use of computer and network technologies in secondary education. These Projects are designed to introduce computer and network technologies into the everyday school practice of more than 370 secondary schools in Greece in every subject on the standard curriculum, in order to create a substantial number of school communities which have incorporated these technologies as an integral part of their daily teaching and learning practice. Project E42 is a particularly important facet of the overall endeavor to inspire in teachers a positive attitude towards the use of the new technologies, while at the same time educating teachers to become capable users of these technologies. The proposed training programs are addressed to teachers of all school subjects, not only computer science. The special one-year post-graduate training programs carried out in the modern Instructor Training Units at selected Greek universities are training a nucleus of 100 selected teacher/educators who will thus be able to provide in-school training for their approximately 6000 colleagues in the Odysseia schools. In that respect the University of Macedonia in Thessaloniki runs the action "EPENDISI" which not only aims to train secondary schoolteachers but also to build a database that contains information and resources on several evaluated educational software available in the market on almost all secondary school subjects (www.ithaca.uom). The evaluation of the software is conducted on the basis of an evaluation model built in University of Macedonia, that examines both social and practical acceptability of educational software (see Georgiadou & Economides 2000). This paper will present the evaluation results on eight online educational software designed for the purpose of teaching programming that address mainly beginners and intermediate students. In the following section, we briefly present each one of the programming software.

On-line Programming Software Presentation

An Introduction to MSW Logo: www.southwest.com.au/~jfuller/logotut/menu.htm
It is a thorough tutorial concerning the programming language MSW Logo. It covers basic programming aspects such as simple commands, the repeat command, functions, variables and some additional features. It includes instructions and suggestions for teachers and additional links concerning Logo.

How C Programming Works: www.howstuffworks.com/c.htm
This is a tool for Web authoring and it is compatible with any browser. Works with self-contained page sets instead of separate pages, offering an easy to use, fast environment to edit sites. It includes tables, maps, frame sets, slides, forms, windows opening, style-sheets and more - all in WYSIWYG.

Introduction to C Programming I: www.cit.ac.nz/smac/cprogram/cstart.htm, http://www.studyweb.com/
This is an in depth tutorial covering the C programming language. It assumes little or no knowledge of the C language, but does assume some knowledge of programming in general. It includes interactive multiple-choice exercises that can help the students to study and understand the issues presented.

Introduction to C Programming II: devcentral.iftech.com/learning/tutorials/c-cpp/c/
This series contains a set of tutorials that help one to learn about the C programming language, which start with the assumption that the user know a procedural language like Pascal or Fortran already, and simply want to map that knowledge to C. These tutorials introduce the user to C by showing him/her how Pascal maps to it. It also introduces several concepts not found in Pascal. Most of these new concepts deal with pointers. Readers coming from a Fortran, Cobol, BASIC, etc. background should find that the Pascal code is easy to read.

Logo: library.thinkquest.org/18446/eintro.shtml
It is a tutorial that concerns the Logo programming language. It includes 10 lessons with the basic aspects of programming, such as simple commands, the repeat command, functions, etc. It also includes examples and exercises that can be modified by the students.

LOGO Programming: members.aol.com/mckoss/logo.htm, http://www.studyweb.com/
This is an online small tutorial for learning LOGO a child's programming language. This tutorial is designed for an adult to assist the child with the learning process.

Pascal Programming v2.1: www.mgu.bg/manuals/pascal/default.htm, www.cit.ac.nz/smac/pascal/default.htm
This is an online courseware for beginning Pascal programming. It starts with a discussion of variables and ends with an online interactive test. Every subject contains exercises that can be done interactively.

rLogo: www.embry.com/rLogo
rLogo is an easy to learn programming language designed for the World Wide Web. It is based on the Logo programming language.

Evaluation

Evaluation Method

For the purpose of the evaluation of educational software a framework has been designed based on the integration of a number of important issues emerged from research on instructional design and system evaluation the past fifteen years, and which should be considered from designers and evaluators of hypermedia courseware. The framework is concerned with both social and practical acceptability of educational software, based on Nielsen's idea that "the overall acceptability of a computer system is a combination of its social and practical acceptability" (Nielsen 1990). The term social acceptability is related with the social basis of an educational system. In cases when the basis is teacher-centered, then the software that provides high levels of learner control is possibly socially unacceptable and vice versa. Given that a piece of educational software is socially acceptable, its practical acceptability is examined through the evaluation of the following sectors: Content, Presentation and Organization of the Content, Technical Support and Update Process, and finally, the Evaluation of Learning. All sectors are equally important, as educational software has to be simultaneously pedagogically and technically sound. Moreover, each sector includes a number of criteria, which should be meet in a satisfactory level, in order to characterize a piece of educational software of high quality. Furthermore, cost-effectiveness is always being examined when similar products seem to have the same educational value. The following figure (Fig. 1) presents all factors included in the framework only in a diagram due to the lack of space. However, all the details about it can be found in "Evaluation Factors of Educational Software" (Georgiadou & Economides 2000).

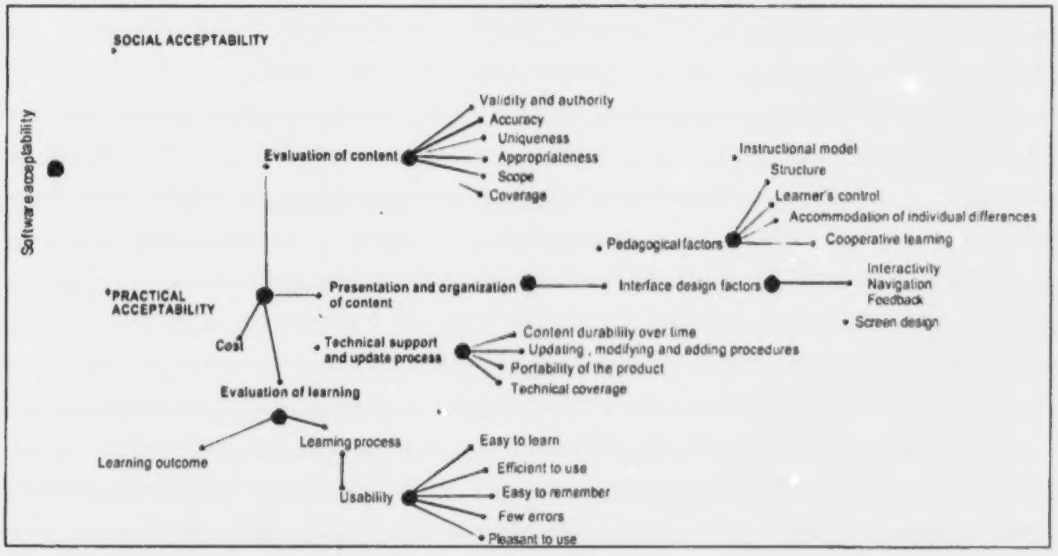

Figure 1. Diagram of the Evaluation Framework

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All the above issues were used as a basis for the development of evaluation instruments mainly in the form of a suitability scale questionnaire and the evaluation was conducted from a team of researchers on educational technology in the University of Macedonia. The items included in the questionnaire were fixed alternative, with six-point scaled format from 'strongly disagree' (1) to 'strongly agree' (5) including a 'non-applicable' point (0). Some example items follow that are concerned with the Interactivity – Navigation – Feedback sector, included in Interface Design Factors (see Tessmer, Jonassen, & Caverly 1989).

1. The system has help key to get procedural information	0 1 2 3 4 5
2. The system has answer key for answering a question	0 1 2 3 4 5
3. The system has glossary key for seeing the definition of any term	0 1 2 3 4 5

Data Processing

The evaluation was conducted for each one of the titles mentioned above and then the sum of the scores of all items for every title was compared with the scores of the other titles. However, not only the overall sum was examined but also the sum for any given sector in practical acceptability i.e. Content, Presentation and Organization of the Content, Technical Support and Update Process and finally, the Evaluation of Learning. This approach was chosen in order to ensure the case when a title is pedagogically sound but lacks in terms of interface design and vice versa. The following table (Tab. 1) presents the results of the evaluation in percentage mode where 100% corresponds to the maximum value. Despite that every factor and sub-factors were examined separately during the evaluation process, the table presents principally the results of the main factors in order to allow easy interpretation. For example, the Interface Design Factors included in the 'Presentation and Organization of the Content' sector integrate Interactivity-Navigation-Feedback and Screen Design parameters as shown in (Fig. 1). However, (Tab.1) gives a single percentage for Interface Design. Also, it has to be mentioned that with regards to the evaluation of learning, Table 1 is concerned only with the Learning Process, i.e. Usability Evaluation and not with the Learning Outcomes which are typically evaluated with performance tests or assignments used to judge the quality and the quantity of learning as resulted scores are typically interval or ratio values (or can be transformed as such) so that powerful inferential statistical analysis can be employed to make generalizations about uniform impact.

		Percentage of social acceptability	Overall percentage of practical acceptability	Evaluation of each sector involved in Practical acceptability				
				Content	Presentation and Organization of the Content		Technical support & Update Process	Usability
					Pedagogical Factors	Interface Design Factors		
1	An Introduction to MSW Logo	80%	73%	86%	56%	66%	67%	90%
2	How C Programming Works	80%	70%	85%	62%	63%	50%	88%
3	Introduction to C Programming I	80%	79%	90%	72%	74%	70%	90%
4	Introduction to C Programming II	90%	67%	80%	65%	59%	51%	78%
5	Logo	90%	77%	86%	66%	73%	68%	92%
6	LOGO Programming	80%	65%	75%	62%	53%	63%	72%
7	Pascal Programming v2.1	80%	78%	93%	70%	72%	62%	92%
8	rLogo	80%	65%	86%	61%	55%	47%	78%

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Table 1. Results of the Evaluation in a Percentage Mode

Discussion

This section is concerned with the conclusions derived from the processing of the data, during the evaluation of the software. It is obvious that all the software that has been evaluated has achieved satisfactory gradation in both Social Acceptance and Content Evaluation fields. On the contrary, the majority of the software presents the poorest performance on the 'Presentation and Organization of the Content' field that include Pedagogical and Interface Design factors and in turn the latter include screen design and interactivity-navigation-feedback parameters as shown in (Fig. 1). This difference shows that authors and producers of educational software often still focus on issues related with the validity and authority of the content in expense to issues related with interface design, despite the fact that hypermedia systems provide the necessary technology for highly interactive and potentially adaptive learning environments. Reigeluth and Curtis argued in 1987 that "the failure of so many instructional programs and materials has often been the result of an emphasis solely on content, with little regard for principles of instructional design to produce effective, efficient, and appealing instruction" (Reigeluth & Curtis 1987). The evaluation results show that their argument is still valid; fourteen years after.

Moreover, only four out of eight software examined contain exercises: How C Programming works, Introduction to C Programming I, Introduction to C Programming II, and Pascal Programming v2.1, and from these only two titles support interactive exercises with the appropriate feedback: Introduction to C Programming I and Pascal Programming v2.1. The other titles are limited strictly to simple examples that enhance the understanding but do not support collaboration or interactivity. In addition, it was also noticed that most of the examined software do not take into account the diversity that characterizes most of the students, like different previous experience in some learning fields, motivation, ability of assimilation, etc. With regards to Screen Design, all titles exhibit the information using basically text, images and graphics and not any other screen elements that could motivate the learner and assist him/her in retaining and recalling the information (i.e. video, animation etc.). Only Logo use some moving images as presentation means. Regarding the 'Technical Support' field almost half of the software has inadequate technical support from the designers or the corresponding company. Even fewer software companies offer additional instructions or suggestions for the teacher or even some kind of relative documentation on the potential of the software and teaching scenarios. Information about the hardware and software needed is often limited and inadequate. Additionally, we have concluded that the titles exhibit a lack in information concerning the last update or the frequency in which the site was renewed.

It is generally accepted that the Usability field has achieved relatively high scores in almost all of the cases. Usability is usually associated with five parameters (see Nielsen 1990): (1) Easy to learn: The user can quickly get some work done with the system, (2) Efficient to use: Once the user has learnt the system, a high level of productivity is possible, (3) Easy to remember: The casual user is able to return to using the system after some period without having to learn everything all over, (4) Few errors: Users do not make many errors during the use of the system or if they do so they can easily recover them, (5) Pleasant to use: Users are subjectively satisfied by using the system; they like it. All the environments examined were easy to use and the navigation procedures were simple in understanding even for the moderate student.

Finally, the best scores in all fields were exhibit by "Introduction to C Programming I" that is an in depth tutorial covering the C programming language. It assumes little or no knowledge of the C language, but does assume some knowledge of programming in general. It includes interactive multiple-choice exercises that can help the students to study and understand the issues presented.

However, as an overall conclusion we could say that despite the plethora of educational software available in the market the need for continuous research on evaluation methods and techniques is profound, as educational software has to be pedagogically and technically sound, in order to contribute meaningfully in the improvement of the learning experience. And above all designers and evaluators should always be aware that if educational hypermedia is not well designed, they will create psychological problems for users, such as memory overload and divided attention, or they will fail to suit the variety of ways that people work together or alone (see Preece 1993).

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Information Technology and New forms of Organisations

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Abstract: Nowadays economic logic has changed and has imposed a set of new rules. Those who play by the new rules will prosper; those who ignore them will not thrive in a competitive word. In fact traditional organisational forms and their vertical structures tend to be slow in developing and implementing decisions and less facilitative of innovation. Due to this many management gurus have argued that current models of organizational structure fail to meet the challenges of the information age. Indeed, some commentators claim that the age of traditional organisational is over. They assert that traditional hierarchy outlived its usefulness and new organisational models needed and that IT lies at the heart of these new models for next century. The purpose of this paper is to evaluate the Internet impacts on organisational structures and identify new emerging forms of organisations in the light of IT advances.

Introduction

To evaluate how organisations change Brown and Eisenhardt (1998) consider two theories. One perspective is a Darwinian view, in other word, a process of how living thing grow, adapt, and change. This is *Evolutionary Theory* that describes the process of gradual change across time through variation, selection, and preservation. This theory gives a passive role rather than an active role to organizations. The organisational growth model that has been introduced by Greiner is an evolutionary model. The second and newer perspective is *Complexity Theory*. This theory emphasizes the emergence of surprising called adaptive systems. According to complexity theory, adaptation is most effective in systems that are only partially connected. According to this theory after an unknown period of time a significant event occurs that create a pervasive changes in all aspects of human life. The time of occurrence of such event called Bifurcation Point. Looking backward, when we look in history we can identify many of these bifurcation points, for example, electricity in its time was a bifurcation point. In our age The Internet can be seen as a new bifurcation point.

Internet is a pervasive phenomenon and it is commonly believed hat the Internet and its inherent distributed capabilities that lead to decentralized views. They have had profound effects on organisational structure, because organisations can gain enormous location flexibility in various activities. Nowadays the Internet has overcome distance and organisations now have to deal with different combinations of physical and electronic spaces and places. The challenge for companies in information markets is the shift from physical to electronic infrastructures.

Many factors are driving change -or maybe it is better to say impose change- but as Byrne (2000) report, none is more important than the rise of Internet technologies. According to Johnson (2000) the Internet is going to mature faster than any other development seen to date. He claims, in a traditional organisation, CEO has used information as a power device. In the 21st century Corporation, continuous link between customer, knowledge workers, suppliers and so on is necessary. In such a setting the free flow of information is inevitable. With the Internet everyone can participate, regardless of size and circumstance (Bulloch, 2001).

Using the Internet offers opportunities for reducing operating cost levels and enhancing services (Venkatraman, 2000). It also provides opportunities for leveraging divers sources of expertise within and across organisational boundaries (Venkatraman and Henderson, 1998).

The growth of Internet-based business is truly meteoric (Mahadevan, 2000). A recent report in Purchasing magazine stated that 81% of purchasing professionals use the Internet in their job. That's up from 73 percent in 1998, and represents an incredible increase from 1997, when just 45% of buyers utilized the Web (Johnson, 2000). Ford and General Motors have announced that they will do all procurement over the Web within a year.

(Bulloch, 2001) reports, four years ago, according to a recent CFIB survey, only 30% of firms with 5099 employees were using the Internet to do business. Today that number is 85%. And it is no surprise that 82% of these firms are using the Internet for email, 46% own a Web site, 23% are buying online and 17% are selling online. Some researchers (Teo, et al. 2000) claim, the advent of Internet has increased the importance of IT and opened new opportunities that can dramatically alter way a firm compete, for example Intranet and extranets have enabled firms to reduce costs and streamline business operations.

(Ross, 1999) reports the Poster Gallery in Albuquerque, N.M. sells just about every poster in print, using volume orders to secure discounts from vendors. " In our first year we sold $4000," says Robert Farley, the owner. Two years later, " we're doing about $300000, 99.9% of it on the Internet."

In contrast, Simon (2000) declares that loyalty may be less on the Internet than in traditional organisations. In spite of great advantage, the Internet's effect on centralisation will not be as strong as one might expect, but there is evidence to support both points of view. One of major criticisms of the Internet is that it does not lend itself to a centrally managed environment (Smith, 1999).

Traditional Forms:

In summary, looking backward, four organizational models have been introduced for prescribing how to design an organization to achieve alignment among the various component within the organization and its environment. The models are discussed briefly below:

The Bureaucratic Hierarchy: In bureaucratic organization, authority hierarchy is well defined, duties of employees are clear (division of labor). Organisation characterized by high formalization and employment decisions based on merit .The strength of this model lies in its standardization of activities and doing them in a highly efficient manner (Robbins, 1987). Its two major weakness are too emphasis on specialization leads to subunit conflicts.

The Entrepreneurial Organisation: In contrary of bureaucratic firm, an entrepreneurial firm always looking for innovation, and continually searching for the risky environments (Mintzberg, 1983). The key to success in entrepreneurial organizations is real-time, organization-wide information sharing, and collaboration throughout the organization (Applegate, 1994).

The Matrix Organisation: In effort to minimize environmental complexity, in 1960s, researchers introduced the matrix model. This model characterized by using specialists from various departments to collaborate as a team(s). In contrast with its primary objects, the matrix failed to create asuitable climate throughout the organization. Its various information channels result overlapping authority and power struggles (Robbins, 1987; Applegate, 1994).

The Adhocacy :In dynamic and complex environment, there is a need to sophisticated innovation. Mintzberg (1983) suggest the adhocracy as a final solution, and characterized it as a "highly organic structure, with little formalization of behavior, high horizontal job specialization based on formal training. According to Robbins (1987), adhocracy is a kind of organization with low vertical differentiation, low formalization, decentralization and great flexibility.

Emerging forms: Characteristics and Imperatives

Many studies have been devoted to find characteristics of emerging forms of organizational structures (Miles and Snow, 1992; Klenke, 1994; Applegate, 1994; Chesbtough and Teece, 1996; Hagl III, 1996; Kelly, 1997; Lee, 1997; Li, 1997; Brown and Eisenhardt, 1998; Hitt and Keats, 1998; Venkatraman, 2000 and 1994; Mahadevan, 2000; Symon, 2000; Black and Edwards, 2000; Byrne, 2000; Eisenstat). It is obvious that mentioning all the related studies are far beyond the scope of this paper, however, I will try to evaluate briefly the main ideas of above papers.

A number of terms have been used to describe the organizational form of the future. (Chesbrough & Teece ,1996), Hagel & Armstrang (1997) and Chutchian (1999) called it *Virtual Corporation*. Other names including: *Plug –And –Play Company* (Cairncross, 2000), *Network Organisation* (Black and Edwards, 2000; Byrne, 2000), *Web Company* (Hagel III, 1996), *Knowledge-Creating Company* (Nonaka & Takeuchi, 1995), *Opportunity Based Design* (Eisentat et al. 2001). Despite the different names, all the new forms emphasize on similar

drivers: globalisation (Chesbrough & Teece, 1996, Hitt & Keats, 1998; Symon, 2000; Raynor, 2000) the move to an information economy (Venkatraman, 1994 & 1997; Bjorn & Turner, 1994), flexible environment (Boddy & Buchanan, 1986; Kelly, 1997), to be entrepreneurial and to be responsive to markets (Eisenstat et al., 2001), and customer orientation (venkatraman, 1994 & 2000).

Some commentators identified "technology " as an "imperative" that determine structural characteristics such as span of control, and centralisation of authority (Klenke, 1994). Bjorn (1994) recognise technology as an "enabler", however he argue that it is not technology itself that should be the primary focal point of organisational transformation. It is obvious that IT has had a profound impact on business and organisational structure (Venkatraman, 1994; Miles & Snow, 1992; Li, 1997), and it seems, this trend will continue at faster pace. Particularly, the role of IT to the change in organisational routines, and its potential as a main source of organisational innovation must be emphasized (Venkatraman, 1994, Li & Williams, 2000).

Generally, researchers have argue that in the light of IT advances, organisations have been moved away from centrally coordinated, multi-level hierarchies towards a more flat and flexible structures (Boddy & Buchanan, 1986; Boddy & Gunson, 1996; Li, 1997; Hitt & Keats, 1998; Byrne, 2000). In other words, because vertical structures tend to be slow in developing and implementing decisions and less facilitative on innovation, hierarchical organisational structures are replaced by more horizontal structures (Klenke, 1994). Coordination, in traditional structures, usually was achieved through establishing standards, developing plans and schedules, but a horizontal structure will use more formal integrating mechanisms (Hitt & Keats, 1998).

Today organisations confront a set of new imperatives that have changed the nature of competition. The new situation, need new rules. Successful organisations in 21st firstly must identified new imperatives and then build a proper organisational structure to cope with them. New imperatives can be posed as follows:

Globalisation: Drucker points out that one of the big headaches for companies in the new century will be globalisation (Raynor, 2000). Globalisation has largely been due to worldwide economic development and the opening of domestic markets to foreign firms. A recent survey showed that approximately 50% of small businesses in the US. Were operating in international markets, up from 20% in the early 1990s(Hitt & Keats, 1998). Advanced information technology has overcome the geographical distance (Li & Williams, 1999). In fact all the players in recent years have close ties with each other, but this ties are all electronic (Chutchian, 1999).

Entrepreneurship and Innovation: Traditional business typically concentrate on opportunities they can pursue by them, by contrast, new organisation must encourage their people to look for a richer multiplicity of opportunities, including those that business can't seize alone. Kelly (1997) alleges that one of the main source of wealth in new situation flows directly from innovation. Some researchers claim that innovation is the first rule in globalises economy ((Hitt & Keats, 1998). Companies in Internet Age, require organizing efforts that move beyond efficiency and control to ones that emphasize the ability to take advantage of opportunities (Black & Edwards, 2000).

Customer or service orientation: Customers in new landscape are informed and knowledgeable. Venkatraman & Henderson (1998) and Schacklett (2000), assert that, emergence of electronic customer communities, is one of the most profound aspect of advanced IT. They also argue, in the industrial economy consumers could not be effectively linked together across time and space. Nowadays, using the Internet customers can remotely experience products and services. To be more precise, electronic communities signal a power shift from manufacturers to customers. According to Byrne (2000), future company will tailor its products to each individual by turning customers into partners and giving them the technology to design and demand exactly what they want. He also avers, the real power of IT results from its potential to Tran formative change, and much of that will involve the company's relationship with its customers.

Flexibility: Flexibility is a vital characteristic. Firms must be flexible to manage unpredictable change in their environments. This feature, will able companies to deal with enhanced competition, and rapidly react to competitors. Hitt and Keats (1998), claim success in the 21st century organisation will depend first on building strategic flexibility. As noted earlier Implementing a horizontal structure can also enhance organisational flexibility.

Cost Reduction: In the light of IT advances, over half of web purchasers' view three or more sites before they purchase, consequently, Simon (2000), predicts, price will be even a bigger factor in new landscape. Using IT in many virtual companies have had a dramatic effects on cost reduction. A typical bank transaction costs $1.25 when handled by a teller, 54 cents when done by phone, but the same transaction processed over the Internet costs 2 cents! In some cases a Net-based catalogue system reduced procurement costs to one-twentieth (Byrne, 2000). Roughly 65 % of IT managers believe the Internet technology has reduced costs in their organisations, and 55 % say it has increased revenue (Wilson, 1999). A major impact of the Internet and its inherent distributed capabilities, says Mahadevan (2000), is dramatic reduction in search costs for both the buyers and the sellers

Outsourcing: while moving manufacturing offshore is nothing new to many corporations, Brenner (2000) report, still a significant percentage of corporate purchasing cost is focused on outsourced services from third-

party vendors. Nike creates a global network of organisations to produce athletic shoes instead of keeping all the work inside the organisation (Miles & Snow, 1992). Waters (2000), reports the strong global economy will expand demand for U.S. goods and services. But the domestic labour force will be unable to produce these for a competitive price. Some companies, are finding that they can cut costs and leverage the most out of their staff and budgets if they partner with other companies that specialize in particular areas that they can't do or as efficiently themselves (Chutchian, 1999. Ford Motor Company has process links with Goodyear Tire that allow it to exploit concurrent engineering and reduce the time of new product introduction. The potential benefits are that each partner can leverage the competencies in the extended network without resorting to the costly options of vertical integration. (Vekatraman, 1994). According to Wilson (1999), 53% of IT managers say they are outsourcing at least some of the development of their Internet/Intranet projects.

Improving Quality: As noted earlier, with using the Internet, customers are informed, so corporations must rely on the quality of their product than on the strength of their brand (Hagel III & Armstrong, 1997). There are some evidence that using advanced IT offers opportunities for reducing operational cost levels and /or improving products and services (Vekatraman, 2000).

Cooperation through IT: New situations create a need to "Digitisation", which means simply removing human minds and hands from an organisation's must routine tasks and replacing them with computer and networks (Byrne, 2000). Unlike traditional organisations that most interaction occurs within business units, in a virtual corporation people from a variety of units are worked together (Eisenstat et al., 2001). Recent advances in collaborative software; Internet/intranet technologies and personal desktop video conferencing have facilitated the use of external experts (Hitt & Keats, 1998). Management must encourage collaboration and coordination.

Developing human capital: Human capital has been and will continue to be, the most important asset of every organisation. Management, increasingly, need for knowledge workers and found out that; working in the competitive world is a war. A war for talent; it is a war for three types of resources- financial, human and technology (Venkatraman, 2000). According to InternetWeek's survey, more than 60 percent of IT departments were experiencing a shortage of skilled workers in those fields. According to Li (1997), around half of GNPs of industrialised countries are made up of information contents and it is estimated that around half of the workforce in all these economies are information workers.

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Collaboration Through Online Personal Learning

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Abstract: This paper discusses the online Personal Learning Planner project underway at the National Institute for Community Innovations, and presents some of the details of the theory and thinking that is guiding the development. The web-based software is part of work by the National Institute for Community Innovations (NICI at http://nici-mc2.org) to develop tools for enhancing preservice education and supporting increased use of technology, especially in Professional Development Schools.

Introduction

The online Personal Learning Planner builds a human and machine web-based assistant site that is based on a theory of dialog recently articulated by myself and Anne Friedrichs (Friedrichs, 2000; Friedrchs and Gibson, 2001). The theory of collaborative interaction for learning is consistent with several writers concerned with authenticity, use of technology to create problem-centered learning teams, representation of complex dynamics in educational settings, and online learning. (Carroll, 2000; Gibson, 1999; Gibson & Clarke, 2000; Newmann & Wehlage, 1995; Stiggins, 1997; Wiggins, 1989, NSDC, 2001).

Friedrichs (2000) discusses four distinct dialogue stages that manifest themselves in the Personal Learning Planning process:

1. Sharing Experience: Listening to own and others' inner speech and natural attitude about a skill or concept.
2. Expressing and Examining Diverse Concepts: Recognizing conflicts; analyzing old and new concepts, models and beliefs; working in one's zone of proximal development.
3. Articulatiing Applications and Understandings: Practicing new skills; combining old and new concepts; using others' ideas, using scaffolds to renegotiate understandings.
4. Communicating New Powers and Creations: Celebrating effects of critical analysis

The online Personal Learning Planner (PLP) provides a structure within an online working space with private and public access controlled by the learner to enable the above framework to work among a learner and any group of people serving as critical friends and advisors to the learner. With funding from the U.S. Department of Education under the "Preparing Tomorrow's Teachers to Use Technology" program (http://www.ed.gov/teachtech/). NICI has developed the first version of the PLP as a "critical friends" online space for future teachers who are assembling portfolios of evidence that they meet the standards required for a teaching license. The PLP is designed to assist learners through the processes of:

Self-assessment of strengths, interests and aspirations
Planning preservice education learning goals and projects
Linking goals and projects to valued outcome standards
Creating original work and sharing the work with others
Receiving high quality feedback for the improvement of their work
Documenting and validating the achievement of learning goals
Assisting in the selection and preparation of exhibits of learning

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Future plans for the PLP include many other learner groups such as K12 students and teachers, trainer-of-trainers programs, leadership programs, and groups as learners, for example, school-based action research teams using the site to develop collaborative products and seeking advice from remote experts to shape and validate the group's work.

Groundwork and Rationale

The lineage of the online Personal Learning Planner comes from two sources. One source is a bold move by a local secondary school community in Montpelier, Vermont that in 1993 placed "individualized educational plans for every student" in their long-term strategic plan. This led, in 1995, to the creation and implementation of a school-wide program to place personal learning at the center of a continuous conversation involving all students, their parents or guardians, and caring adults in a school. Support for the school-based development came from the University of Vermont. As well, the writings of researchers and theorists such as Bentley (1999), Moffat (1998), Friedrichs (2000), Gibson (1999 & 2000), influenced the effort. In addition, early in its development, the concept of the Montpelier "PLP" was picked up by the Regional Laboratory at Brown University, and combined with similar movements and interests in Rhode Island, Maine, Massachusetts and other New England states. In Maine, for example, the concept of personal learning took on a primary role in that state's exciting new proposal for the reform of secondary schools. In other work of the Lab, the theme of personalization became a crucial feature of the secondary reform network in the region, and was tied to the principles of "Breaking Ranks," the reform monograph of the National Association of Secondary School Principals. Thus, the concept of personalization of learning as essential to educational reform is well-founded in theory as well as practice.

The other source is the pioneering work of the WEB Project, which makes available web-tools and networked communities for original student work to be shared and critiqued online. The WEB Project successfully brings together working professionals and classroom teachers in support of the improvement of student work by focusing high quality feedback to a learner based on their articulated intentions for their work. The secrets of success of the project are probably many, but it is worth pointing out the learner-centered nature of the online dialogs and the singular focus on creation of original work. Also, the entire sequence of activity in the project only begins if and when a student shares a work-in-progress and asks for specific feedback. These qualities of learner-centeredness, creativity, self-initiative and intellectual focus have been carried forward into the web-based PLP.

The rationale for building a web-based tool focused on the improvement of preservice teacher work has two parts. First, there is a need for feedback to come from a diverse audience, yet preservice and induction programs sometimes have limited resources and structures that produce scant feedback to aspiring teachers. As a result, an aspiring teacher's work evolves in isolation, perpetuating the general conditions of teaching present in most schools today. A web-based professional network can help overcome isolation, but even more important, it can provide the future teacher with high quality information that might not otherwise be available. The advantages of "anytime, anyplace" access to experts is an obvious benefit of a web-tool.

The second rationale is that there is a need for effective documentation of learning beyond paper and pencil formats. Ideally, documentation should be a record of the decisions as well as the validation of the work produced. In small personalized programs, preservice teachers benefit from many interviews and observation/feedback sessions related to their work, but in many programs, that experience is limited to the last few months of preparation. An online personal learning planner can help create a longitudinal multimedia record of growth and change in an aspiring teacher's skills and capabilities

The sources of inspiration and rationale led us to ask "What does preservice teacher work look like?" "What would happen if we could build a site for the improvement of a future teacher's work?" "Could the principles of personalization and helpful feedback in a professional network assist teacher education programs?" The online Personal Learning Plan is a way to pose answers to these kinds of questions.

Critical Components in the Online Personal Learning Plan

One of the first questions often raised is whether online learning of any kind can truly be personal. Isn't person-to-person the most *personal* way to learn? In fact, isn't online work one of the most *impersonal* kinds of interaction there is between humans? I don't wish to argue these points here. Online learning is here to stay. It brings remote resources to the desktop anytime, anyplace. Yes, it is in its infancy. Yes, it lacks many important features needed for rich human communication, but so does writing, film, video, and even talking. Using new communication tools in learning is a matter of integration and balance and its effectiveness depends mightily on the attributes of both the learner and teacher. In spite of these challenges, online learning is growing and evolving at a rapid pace.

The Online PLP promotes a uniquely learner-centered approach to the challenge of integration and balance of technology in learning. The following basic assumptions guide the thinking behind the NICI - PLP.

Face-to-Face as a Foundation of Learning

The online world is an extension of human contact. The Online PLP doesn't and cannot replace face-to-face contact needed for learning; it extends, deepens and enhances personal contact.

Three bases for planning and action for learning

The purposes of learning can be categorized by three domains:
Institutional priorities – our shared community goals
Professional priorities – our scholarly traditions and expectations
Personal priorities – our source of deep meaning

The Learning Cycle

The Online PLP can be a powerful extension and helpmate in the "action research" process of planning, doing, reflecting and consolidating knowledge.

Focus on the learner's work

The learner's productivity and self-efficacy is the ultimate goal of the Online PLP. Work samples are the critical source for evidence of learning, the documentation of progress, and the verification that high standards have been achieved.

Self-Direction and Making Meaning

Learners produce better and are more highly motivated the more they have decision-making power over their learning. Learners gain from posing questions to advisors, and from knowing about, developing and using a variety of learning assets - their strengths, interests, aspirations, community and personal resources. All learning is a matter of making personal meaning out of the alternatives presented in experience.

Flexible Thinking Tools

Learners gain from scaffolding and assistance in stages and types of thinking, for example, divergent thinking, using multiple frameworks and perspectives, and so forth.

Structure and Roles

The online Personal Learning Planner allows all media formats and a multiplicity of linkages among learning goals, projects, and the evidence of attainment of standards of performance. Distinct from electronic portfolios that concentrate on the presentation and storage of completed work, the PLP concentrates on the improvement of work and the documentation of change of work over time.

Three user levels and a server administrator level are provided. Users levels include the Learner, Advisors, and a Program Administrator. The learner is in charge of their PLP. They create or choose goals, link them to standards or other external sources, create work that stands in relationship to the goals, make decisions on when both goals and work will be shared with advisors, and decide when work and goals are to be archived into permanent storage. Learners can make digital collections from their body of completed work. Each collection is presented as a self-contained website in which each work can independently attach reflections, summative evaluation, and new context-setting narrative and graphics.

Advisors are associated with one or more learners. When a learner's goal or work is being shared for

critique and feedback, the Advisor can discuss, offer direct edits or validate the goal or work as adequate for its purpose. For example, a goal might be validated as appropriate to completion of a secondary teaching license in science; a piece of work might be validated as evidence of achieving a standard of performance linked to one or more goals. The validation process can be formalized with rubrics or left as narrative, and any rubric can be associated with any piece of work's link as evidence. When a group of advisors scores a work using a common rubric, a summative rubric can be built upon completion of the work.

The Program Administrator can review all Learners and Advisor records, add and delete Learners and Advisors, set defaults on the number of advisors that need to agree in order for validation to be complete, create rubrics, create and edit standards, and make other selections associated with program management. The Server Administrator controls the hardware and communication decisions needed for site maintenance and archiving.

PLP as a Team Tool

The use of the PLP as a team tool assumes that agency for a group operates much like it does for an individual, once internal communication and trust within the group has been developed. Outside reviewers can be invited to become project advisors. The PLP allows anonymous or "tagged" contributions by group members to facilitate both group and individual accountability. As a collaborative tool, the PLP facilitates building a group's history as well as a collection of validated work products.

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Self- Assembling Texts & Courses of Study

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Abstract: This paper describes the development of an interoperable meta-database system - a system of applications using metadata - that is intended to facilitate learner-centered collaboration, access to learning resources, and the fitness of channels of information to the emerging needs of learners at both individual and group levels. The new web-based educational database applications are preparing to use the concepts of self-assembly to treat digital media paths as a new form of "texts and courses" in education.

Introduction

New media = new modes of thinking. New tools for thinking and expressing have a profound effect on learning. They don't just change how we access information. New tools change the very modalities, scope and depth of how we see and interact with the world. For example, because MTV music videos led to television and print ad commercials with documentary-like, visual flashes of information; textual narratives of the past have given way to film-like story lines. Because online "chat rooms" led to new forms of "talking" with several people at once and asynchronous "listservs" and "threaded discussions" led to group archives, the concept of classroom dialog is evolving. Being able to see the 3-dimensional structure of a storm leads to new insights into the complex dynamics involved. And math classes with computer simulations and modeling are a different breed than math classes with only a pencil or chalkboard for representation. These are examples of how new media changes thinking as well as ways of working.

Learning through texts and courses is evolving to take advantage of new media and the globally connected web of experts, knowledge and tools. "Texts" now mean rich digital media streams; "courses" mean episodes and series of engagements spread across space and time. In both texts and courses, the static pre-planned paths and chapters of the past are giving way to more flexible ways of putting materials together for learning. This paper begins to discuss the application of the concept of self-assembly in a new web-based educational database application that treats digital media paths as a new form of "texts and courses" in education.

Self-Assembly

The word phrase "self-assembly" refers to something that is capable of putting itself together. The phrase also brings up images of self-organization, pulling oneself up by the bootstraps, spontaneous generation, and evolution - "something" coming from "nothing." How do these processes work and what might they mean for educational texts and curriculum?

Processes of self-organization are prevalent in both materials sciences and artificial intelligence research today. In materials science, self-assembly most often refers to the three-dimensional conformation of materials brought about by catalytic agents or processes; for example, through evaporation and vibration. (AMP, 1998 & 2000; Discover, 1998; Ingber, 1998) Engineers who previously thought in Cartesian, gears-and-straight-line terms are finding the mixture of biology and hardware and software to be liberating. (Petit, 1998)

In artificial intelligence (AI) research, self-assembly approaches include using "neural networks," "genetic algorithms" and "genetic programming" as the catalytic agents and processes (Engel, 2000; Sette,

Boullart & Van Langenhove, 1997). In the world of information and AI, as the conformational role expands to mean interacting-bodies of information, the complexity expands to n-dimensions, in configurations sometimes referred to as "landscapes" where "fitness" processes occur. The brain science and evolutionary metaphors in AI begin to give us clues as to why we might want to pay attention to self-assembly of texts and courses. The AI approaches have been characterized as:

- convenient for the implementation of model-based control strategies (Kulkarni, Tambe & Dahule, 1999)
- producing good results when a search field is too large to use conventional search or optimization techniques, and possessing an ability to undertake searches with few presumptions about the outcome (von Rönik, 1997)
- Useful when the complexity of a process is very high and no mathematical function is known to exist that represents the whole process; and where there are multiple objectives for optimization (Sette, Boullart & Van Langenhove, 1997)

We explore here two extensions of these kind of core ideas for a web-based set of educational applications. We envision "texts" (meaning any digital multimedia format used in teaching – digital video, audio, texts, pictures, tactile computer interfaces such as steering wheels, ramps and pulleys) and "courses of study" (meaning a planned and coordinated sequence of learning episodes) that can put themselves together. Some concepts helpful for the discussion:

- **Elements and Paths** – multimedia granules or chunks of information connected in a web of relationships through one or more "story lines." Elements can be singular or organized into complexes via subpaths. A path refers to a longer line of thinking/representation that organizes several elements or complexes. An element is a thing; a path is a relationship.

- **Fitness functions** – defined in part by the strengths, interests and aspirations of a learner, and in part by the professional and organizational goals in the learner's contexts. Fitness occurs when the learner's profile meets the structure of information and an exchange of resources occurs that is mutually beneficial to the learner and the world of knowledge.

- **Recombination** – mixing up elements of information and presenting new cross-fertilized ways of seeing and thinking about those chunks.

- **Feed Forward & Feedback Paths and Loops** – linear and nonlinear connections among the elements, which can have positive and negative influence on other element complexes as they form internal and external relationships.

A metaphor for the connections is a "loop," "trail" or "path" model of cross-referenced materials. For example, let's use three separate four-element paths to illustrate (Figure 1). In the first path, four multimedia elements (text, sound, video, jpg, etc) are associated with a theme such as "teaching civil rights in a high school history class." One of the elements is a video clip of "Martin Luther King" and is also found on a second path having to do with speeches of political leaders in the early 20th century after World War II. That path intersects with a third path that contains other post-war elements of culture and society.

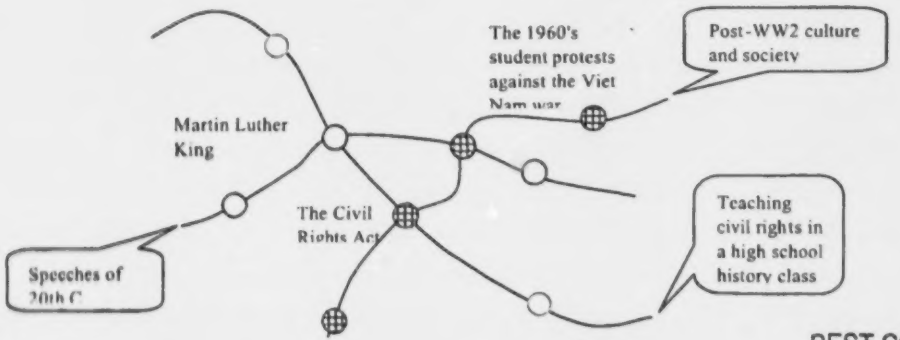
The 1960's student protests against the Viet Nam war
Post-WW2 culture and society
Martin Luther King
The Civil Rights Act
Teaching civil rights in a high school history class
Speeches of 20th C

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Figure 1. A path model of cross-referenced materials

The media chunks represented by element points in the web of relationships are small self-contained, self-running, self-explanatory chunks of digital information with metadata that assists in the formation of the paths. Possibilities for the metadata include

- "Audience" with qualifiers for age, grade level or level of expertise
- "Discipline" making an association with the media chunk for application within a specific field of knowledge. (e.g. the "I Have a Dream" speech as part of fields such as Political Science, Television & Media, or African American Studies)
- "Theme or Big Idea" taking the expert consensus on the major ideas of the related discipline and relating those to the elements (e.g. the King speech as Oratory, Documentary, Facing Historical Oppression).
- "Teaching points" with subject-object-predicate structures such as "galvanized public opinion about rights," "influenced the media and arts," or "led to campus riots." The teaching points might be story summaries among many that are subsets of the discipline using that element.
- "Story Line" a framework for basic narrative flow, e.g. beginning, middle, end, flashback series, historical, working backwards from high point, theme and variations, metaphoric comparisons, struggle of opposites, montage, etc.
- "Position" information in terms of outline or story line hierarchy such as "overview," "descriptive detail," "justification," "opposing view to x," etc.
- "Order or precedence" using historical, logical, causal, etc.

The paths connecting elements are multicausal (complex nonlinear) relationships with bidirectional capabilities. One element can have a positive influence on the next element or group of elements at one point in time, and have a negative influence at another point in time. As well, within each element there can be a complex crossing of directionality (e.g. playing different influence roles in two different paths at the same time). The agent will have to maintain simultaneous contradictory channels in an evolving configuration of relationships. "Meaning" within the channels will come at least partially from a model of the path as a whole, and in some instances, from "crosstalk" or superposition of wave functions within the element or a subpath itself.

The weights in the valuation structure of the model of the learner will play a role in defining the paths and determining the distances between elements on different paths. The natural language-like structures of the metadata will constitute a fuzzy model of the world that has two perspectives: the "model of the learner" perspective and the "model of the field of knowledge" (the combined weighted paths of the participating experts' models of the field of knowledge). When these two perspectives meet each other, there is a kind of tug of war between the learner's interests and ideas with those of the field, leading to the idea of "fitness" of the two perspectives or landscapes for each other. (see Csikszentmihalyi, 1996)

Fitness functions in the context of texts and courses will refer to the evolving configurations of strengths, interests and aspirations of a learner, as well as the professional and organizational goals in the learner's contexts. Both direct and implied collection & analysis methods will create the functions. For example, a direct collection method might be a survey of the learner, a personal profile, a test, or an interview. Implied collection methods might include tracking a learner's searches, uses of resources, and public communications with experts and others.

The self-assembling text will need to be able to build a model of the learner and adjusts its model over time to fit the changing configurations of the learner. In short, it needs to involve an adaptive agent that represents the learner in the web space and interact with other adaptive agents representing the knowledge structures in the web space. Valuation functions with weighted sums, as used in Arthur Samuel's checkers game player (1959) may provide the kind of thinking needed to construct the agents.

With the idea of recombination, we get both abundance and new connections. Abundance is needed to generate alternatives and new connections are needed to store memories of the past and to measure the distance of those to future connections.

Self- Assembling Texts

We are using the word "text" to mean a rich digital media stream utilizing all forms of storytelling, film and video, reading, audio, visualization and so forth.

Several scaffolds, narratives, streams of thought, outlines and story line formats at various "sizes and shapes" (determined for example by time to display and read/view, number of elements, and message complexity) will provide seed structures for the self assembly of texts. Time scales might range from 5 to 15 minute episodes to several hours, as in a miniseries, that would take several days to experience, but that could be approached in convenient samples of time. The number of elements might range from 3 or 4 (each of which may involve several media subelements and last from 30 seconds to 2 or 3 minutes) to several hundred or thousand per story line. Message complexity may have both intensive and extensive dimensions. Intensively, the level of complexity refers to the detail, depth of coverage and the vertically integrative scope of the topic within one or more representation hierarchies (as in part to whole relationships). Extensively, the level of complexity refers to the "same level" or peer-to-peer scope of relationships involved in the story line (as in whole to whole relationships). The complexity levels may be defined in terms of the numbers of elements, connectors, loops, and intersections both internally and externally that constitute a particular weighted path for the current purposes of a story line.

The seed structure of the self-assembling text implies that we need to create a new form of metadata that sits at a higher level of abstraction utilizing lower level metatagged media elements as pieces. For example, given a topic such as "stream biology" there may be many "introductory" sequences, which are differentiated to suit "body messages" of "macroinvertebrates", "energy production", or "city and recreational planning."

Production of the metadata structure of the story lines can at first come from existing texts, films and other media productions, but the ideal system will then evolve with new paths being added by knowledge-producing learners and experts.

Self- Assembling Courses of Study

The old structure of schooling was dominated by courses of study that had been created by a single teacher. The courses were designed to move a group of learners from some level of knowledge and ability to another, coordinated primarily through common texts, exercises and tests held at common meeting times.

The new structure of learning made possible by "anytime, anywhere" telecommunication networks and new media allows a natural emergence of a course of study. The course of study arises out of the interactions and dialog among a learner's expressions of interest, strengths and aspirations, a peer and expert community that shares interests as well as guides the learner, and the wider world of expertise systems.

As new courses develop, old educational functions take on new meaning. For example, "registration" will be accomplished through searches, self-assessment, and asking questions. "Forming goals" for the course will occur within a dialog with scaffolded self-guidance and with advisors and other learners. "Monitoring progress" will occur through learner and advisor talks, draft works and the feedback process, and ongoing assessment. "Completion and validation" of course and program attainment will follow how a work becomes evidence. Paths and subpaths will link up into book-length units. Role of human mediation w/agents and texts will become an integrated support system for the learner.

In the Personal Learning Planner (PLP), recently created by the National Institute for Community Innovations, a number of online structures are moving into place to take advantage of the self-assembly of texts and courses. Performances are moved outside of classrooms and focused on evidence of a small number of important standards. Common stable scoring guides with examples of work are provided across a boundary-free professional landscape. Managing multiple non-linear pathways of choice by learners and advisor groups and individuals is supported.

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Gilbert's Usability Monitor (GUM)

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Abstract: With the continued growth of the World Wide Web, the task of determining interface usability has become much more complicated. The days of focus groups and usability studies are becoming more difficult as applications are being ported to the Web. Today's user base spreads across culture, age, gender and professional boundaries. Conducting a usability study has never been more difficult. This paper introduces Gilbert's Usability Monitor (GUM). GUM is a new form of usability that addresses interfaces that have a volatile user base, such as Web based applications.

Introduction

There are several different methods that determine usability. Usability methods can be categorized as inquiry, inspection or testing methods. Inquiry methods include surveys, questionnaires, interviews, focus groups and field observations (Hom 1996). Inspection methods include heuristic evaluations (Nielsen 1992), cognitive walkthroughs (Rowley 1992 & Wharton 1994), structured observations (Lund 1985), user modeling (Gong 1994) and Pluralistic Walkthroughs (Hom 1996). Popular testing methods involve Think Aloud Protocols, Question Asking Protocols (Hom 1996) and Remote Testing (Hartson 1996). These methods generally require additional usability experts, test users, expensive equipment or inconvenient time commitments. For these reasons, interface designers will often skip or reduce usability testing. Gilbert's Usability Monitor (GUM) offers an alternative to these approaches that eliminates the additional usability experts, expensive equipment, test users and inconvenient time commitments.

GUM is a hybrid usability method that combines techniques from prototyping and remote testing (Hartson 1996). The prototyping technique that GUM is modeled after is the reusable or evolutionary prototyping method (Hom 1996). This method involves the design of a functional prototype that contains part or all of the completed product. The prototype may undergo several modifications before the final version has been created, which will be a product of the original prototype. GUM combines the prototyping strategy with remote testing. GUM gathers data about the user's interactions remotely over the network as the user is using the interface. GUM automatically evaluates the user's interaction in real time. GUM creates a model of the interface with respect to how the designer intends the interface will be used. The interface's usability will be evaluated against this model in real time with real users. GUM is based upon the premise that **an interface is not usable, unless it is used by a real user according to the designer's original design**. It is possible for a designer to design an interface to be used in a specific manner, yet the users use the interface in a different way. This interface is usable according to the user's satisfaction, but not with respect to the interface's original design. The designer can adopt the user's view of the system, which will make the system usable by this definition. Usability can be measured with respect to effectiveness, efficiency and satisfaction (Frøkjær 2000). GUM measures effectiveness and efficiency, but not satisfaction.

Monitoring Usability

The goal of GUM's design phase is to create a model of how the interface is to be used. This model will be created according to the designer's intent on how users will make use of the interface, i.e. an interaction model. The interaction model is created after the development has been completed and before

the product is released. The designer creates the interaction model by example use. In other words, the designer uses the application as he/she expects users to use the application. While the designer is using the application, GUM is recording each move that is being made. This process records how the designer expects the interface to be used by real users. The output of this process is an interface interaction model, which is stored in a server side database for use during the evaluation phase.

The evaluation phase of GUM introduces the concept of rapid prototyping. GUM uses a form of reusable or evolutionary prototyping where the prototype is a working model. The designer will make changes to the working model based upon real time user interactions. Each user's interactions will be compared to the interaction model. The designer will make changes to the interface based upon feedback from the usability monitor.

The usability monitor runs periodically and searches the database for usability contradictions. Usability contradictions occur when the interface is being used in a manner that conflicts with the interface interaction model. If a contradiction is found, the usability monitor will send an email notification to the designer stating that a contradiction has occurred. Upon receipt of the email message, the designer will make the appropriate modifications. The modifications may require interface changes or changes to the interface interaction model.

Conclusion

GUM is under development and requires future experimentation with new and existing Web sites. GUM provides an effective means of measuring usability remotely. GUM defines usability with respect to the designer's original intent on how the interface is to be used. This usability measurement can provide feedback to the designer when their original design is being violated. GUM provides the designer with the absolute facts, which in turn, give the designer the opportunity to improve the interface before users are completely turned away or accept how the interface is being used. GUM does not replace the other usability testing methods, it simply improves upon them and gives the designer another testing option.

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Building Learning Architectures: Domain Instruction Server (DIS)

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Abstract: Web based instruction is growing at an incredible rate. Teachers, instructors, trainers and several others are putting their instructional content online. The format, style and media types vary from instructor to instructor. In essence web based instruction is being done by an unknown number of people in an unknown number of ways using different media types and platforms. In this paper, an instruction repository will be introduced that has the ability to unite all web based instruction under one umbrella. The media types, platforms, instructors and formats will remain independent. The repository creates a new learning architecture for web based instruction.

Introduction

The web has been heavily populated with instruction. There is an unknown number of instructional lessons on the web. Finding useful instruction on the web is a very difficult task. This task creates the need for an unifying repository. The creation of such a repository would facilitate ease of search, reuse and universal access. This learning architecture would create a new model of instruction. In the traditional classroom, there exists a one-to-many instructor-student model. There is one instructor teaching many students. In a tutoring environment, there exists a one-to-one instructor-student model. Implementing this new learning architecture, the instructional model will be changed to a many-to-one instructor-student model (Gilbert 1999). This repository of instruction will provide each student with many instructors facilitating a many-to-one instructional model. In this instructional model, the major task is matching students to instructors that accommodate their learning style (Dunn 1978). In the sections that follow, the architecture for a distributed instruction repository will be discussed.

Repository Model

The internet consists of several domain name servers. Each domain name server contains a list of domain names, i.e.: www.eng.auburn.edu , and a corresponding IP address. When a browser connects to the web, it will ask a domain name server for an IP address before it is connected to the requested web site. This model can be adopted to define a learning architecture that consists of an instruction repository with domain names and instructional meta data.

In the instruction repository, instructors/teachers can submit queries that will yield a domain name. The domain name will correspond to an instructional lesson on the web. This function is similar to the domain name service, but it also models credit card processing on the web. For example, most electronic commerce sites buy or lease merchant services from a merchant service provider. The merchant service provider gives the store owner access to their credit card processing server. The store owner submits a query to the credit card processing server and the server returns a response code. The response code

informs the store owner of an acceptance or rejection of the credit card transaction. By combining the credit card processing model and the domain name service model, a new learning architecture can be implemented. This new learning architecture is the Domain Instruction Server (DIS) environment.

Domain Instruction Server (DIS)

The Domain Instruction Server (DIS) is a repository consisting of web deliverable instructional lessons. The sequential organization of a collection of instructional lessons defines a course. Instructional lessons are created by an instructor and placed on a web server. The web server may belong to their college, school, company, internet service provider or it may be their own personal machine. In any case, the web server is world accessible and it contains their instructional lessons. Each instructional lesson has several common attributes. These attributes can be viewed as instructional meta data.

The instructional meta data associated with each instructional lesson is uniquely identified by a location attribute. The location attribute is a web address that points to the first page of the instructional lesson. For example, if an instructor creates a web based course that consists of 30 instructional lessons. Each instructional lesson will have a first page. This first page will have a corresponding web address. This web address will be stored as part of the meta data for each instructional lesson. All subsequent pages that follow the first page will be linked from the first page. A few of the other meta data attributes are:

- Lesson Name
- Instructor's Contact Information (name, email, etc.)
- Instruction Method-Media (i.e. Visual, Audio, Video)
- End Of Lesson Quiz Location
- Lowest Passing Score
- Assistant(s) Contact Information (i.e. Graders)
- General Description

These attributes are common across all instructional lessons stored within the repository. By collecting several instructional lessons from several instructors the repository creates a high level view for each course as seen in figure 1.

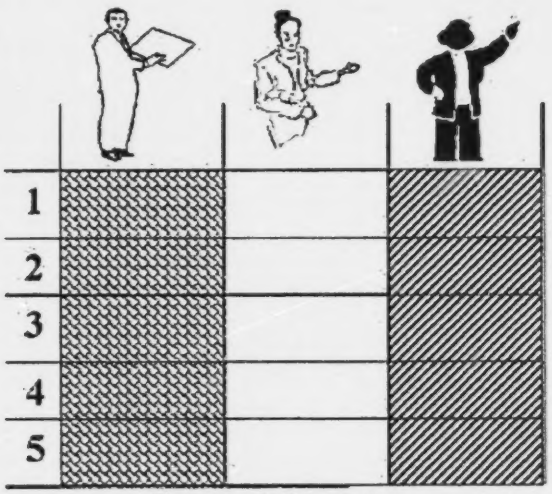

Figure 1: High level view

In figure 1, there are three instructors teaching the same course. This course is composed of five lessons and fifteen different instructional lessons. Each row in figure 1 corresponds to a lesson, i.e. an entry on a syllabus. The columns under each instructor represent an individual course taught by the above instructor.

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Each instructor teaches the same course using a different media type or style. Each rectangle in figure 1 is an instructional lesson consisting of all the meta data mentioned above. Figure 1 is a high level view of the DIS organization. The lower level architecture is discussed next.

DIS Architecture

The architecture that supports the DIS environment is very flexible. The primary objective in defining the architecture is to obtain total flexibility with respect to varying platforms across various implementations. This architecture must be platform independent, universally accessible and easy to use. With these requirements in mind, the architecture in figure 2 was defined.

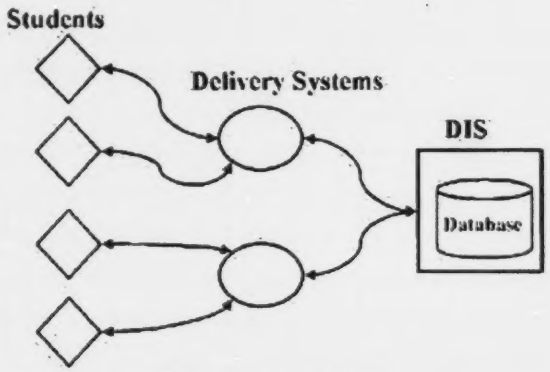

Figure 2: DIS Architecture

In figure 2, there are three layers. The first layer consists of the students. These are designated by the diamonds. The students are using a web browser to connect to the second layer. The second layer is composed of multiple delivery systems.

Delivery systems are the middleware that provide instructor flexibility for their instructional lesson selection process. Within the DIS architecture, there exists the concept of instruction method selection. As described by figure 1, the DIS contains several instructional lessons. These instructional lessons have to be selected for use. The process of selecting an instructional lesson for use is called "instruction method selection" (Gilbert 2000) Within instruction method selection the tasks of how, when and which instructional lesson to select must be addressed. For example, in figure 1 there are three different instructors teaching the same course consisting of five different instructional lessons. The first instructor may choose to use instructional lesson number 2 before instructional lesson number 1. In this case, the sequence of the instructional lessons for the first instructor would be 2, 1, 3, 4 and 5. The other instructors will sequence their units as 1, 2, 3, 4 and 5. This difference in instructional lesson sequencing can be facilitated through the use of two different delivery systems. Each delivery system uses the same repository to select instructional lessons, yet the order in which the instructional lessons are selected differs. Delivery systems may also vary on how and when to select an instructional lesson.

Instructional lessons are generally selected after one instructional lesson has been completed. This process is common between all delivery systems. In general, each instructional lesson contains an evaluation measure. Typically, the evaluation measure is in the form of a quiz. Based upon the student's performance on the instructional lesson's quiz, the next instructional lesson can be selected. Gilbert (2000) used case-based reasoning (Kolodner 1993) as the instruction method selection technique. For example, when a student completed an instructional lesson, the student was given a quiz. If the student scored 80% or better on the quiz, the next logical instructional lesson was selected using the same instructor's method. The 80% can be viewed as an instruction method selection threshold. If the student scored below 80%, the student was forced to retake the lesson using a different instruction method. The instruction method was selected by treating the student's quiz as a case which was compared to other quiz cases. If there was a match, then the student was assigned an instructional lesson based upon a previously observed quiz case.

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Gilbert's method of instruction selection was implemented using one specific delivery system. It is possible to implement other methods. For example, it is possible to implement a delivery system that uses neural networks to perform instruction method selection when students perform below 75% on an instructional lesson's quiz. Also, delivery systems can vary across user interfaces. The user interface for each delivery system could be different. Delivery systems consist of at least four major components.

- Instructional lesson sequencing.
- Instruction method selection threshold.
- Instruction method selection technique.
- User interface.

It is possible that delivery systems may consist of more components, but the four listed above are a minimum.

The DIS environment may be composed of more than one server. Figure 2 illustrates an implementation with one server. Figure 3 show a possible configuration that contains more than one server. Figure 3's implementation models the domain name server implementation. There may be multiple servers, but each server contains the same information. In figures 2 and 3, each server contains a database. This database is the repository that contains all of the meta data for each instructional lesson. Instructional lessons are added to the database by the instructors. Instructors must subscribe to the DIS service. This is accomplished by filling out a form on one of the servers that is part of the system. Once an instructor subscribes, they will have the ability to register their instructional lessons. Registration is accomplished by putting your instructional lessons' meta data into the database by using the forms. After the instructor and their instructional lessons are added to the database, the instructor can start using a delivery system. All delivery systems communicate with the server using the same communication protocol.

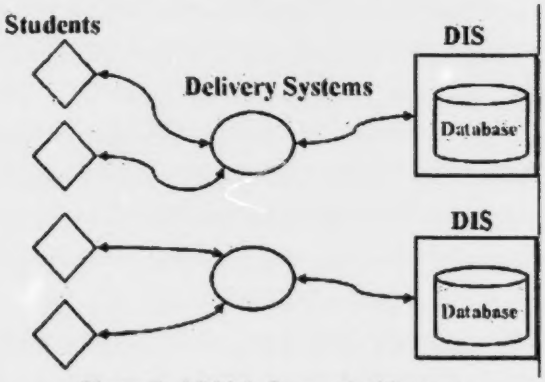

Figure 3: Multiple Servers Architecture

Delivery systems submit queries to the DIS using the HTTP form POST protocol. The most common query will be a request for a list of instructional lessons associated with a course. The first step to submitting a query is the creation of a form in html code. In most cases, the form will consists of hidden fields with specified values. Figure 4 gives an example of a query that requests a list of all the instructional lessons for an Algebra II course. The html code in figure 4 contains several hidden form attributes. For example, the R_URL attribute contains the web address of where to send the results of this query. The results of this query will be sent using the HTTP form POST method as well.

```
<FORM ACTION="https://.../dis" METHOD="POST">
<INPUT type="hidden" name="R_URL" value="https://.../script">
<input type="hidden" name="Login" value="Your-DIS-ID">
<input type="hidden" name="Course" value="Algebra II">
<input type="hidden" name="Query" value="List_All_IU">
</FORM>
```

Figure 4: Sample query from a delivery system

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In other words, the delivery system will post a message to a server within the DIS environment. The server will read the form attributes and execute the corresponding query. The results will be written to the user's browser and immediately posted to the web address in the R_URL field. The Course, Login and Query attributes are very straight forward. These attributes correspond to the course being taught, the instructor's login and the query that is to be executed. This simple query is a small example of how the delivery system communicates with the server(s) within the DIS environment.

Conclusion

The DIS environment defines a learning architecture for web based instruction. The DIS environment is designed to work with schools, universities, industry, individuals, etc. DIS serves the purpose of adding a new instructional, many-to-one instructor-student model for web based instruction. This new model of instruction will link students to instructors that before now, may have been impossible to learn from. This will be extremely useful for rural school systems that are experiencing teacher shortages. With the increase of instruction on the web, DIS provides an interface for instructors to find existing lessons under a common interface. This will increase the use and reuse of instructional lessons on the web. Learning architectures for web based instruction should facilitate ease of search, use, reuse and adaptability. The DIS architecture is designed to accomplish all of those features.

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Going Wireless: Practical Issues for Teaching and Learning

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Abstract: Which educational objectives can be achieved and what kind of problems do educators and students encounter using wireless laptops connected to the Internet in the classroom? This paper describes and presents the results of an in-depth study on the introduction of laptops in academic education at the Free University of Brussels, Belgium. By means of participant observations, questionnaires and interviews we analysed the (changes in) classroom practices and the diversified use of wireless notebook computers in nine different disciplines (humanities and exact sciences).

Introduction

Numerous institutions incorporated laptop programmes in their educational settings. Each of these different approaches yielded positive outcomes (Rockman et.al., 1997; Studenten Service Centrum, 2000). Nevertheless, few evaluations have been made on the introduction of *wireless* laptop computers. Going wireless with notebooks in the classroom provides educators and students new perspectives: ease of movement, flexibility, convenience, cost effectiveness and time saving (Skelton, 2001).

The Free University of Brussels intends to equip all its students with wireless laptop computers. First, the university initiated a pilot project "Learning by Doing - Interactive Education in the Wireless Laptop Class". During one semester small scaled experiments were conducted, thoroughly described and evaluated.
The specific concerns are:

- The use of new didactical approaches supported by ICT
- Development of a supportive model for educators (both technical and pedagogical)
- Sensibilisation of other, not participating educators
- Finding more precise answers to students' need for (laptop) computers

A classroom was equipped with wireless access to the Internet and computer projection devices. The pilot year implementation involved 10 educators from different faculties, selected on the basis of their project proposal. The groups of students were not larger than 40 students (max. 2 students per laptop). Some of them were familiar with innovative technologies, others had never been in touch with new educational methods. Every participating educator was assigned a notebook computer. Prior to the start of the pilot project in the second semester of the academic year 2000-2001, three introductory sessions were held with all the instructors, the project leader, the technical support staff and the researchers.
It was decided to use block scheduling for 37 sessions. The domains covered were: Theory of Architecture, Research in Criminology, French, History, Survey Research, Toxicology, Mathematics, International Law and Maritime Law.

Research methodology

Multiple research methods were used to assess this pilot project: a questionnaire was administered to all the participating students (N= 133), we did in-depth interviews with 2 complete student groups (N=13) and made participant observations (22) . Only open-ended questions were used in the survey.
Besides items such as computer use (in classrooms), ICT needs and knowledge, the survey assessed students' attitudes toward educational innovations and more specifically to the wireless laptop pilot project.

The observations took place with the aid of a structured observation list. During the course of our research we obtained other – more informal - information from instructors and project collaborators. Also, educators were required to keep teaching journals.

Findings

The classroom practices varied quite considerably across the involved in the laptop program, related to the educators' technology capabilities, preparation, and specific curriculum. Some educators experimented with teaching strategies that differ from their traditional approaches. The wireless laptop program seemed to encourage both process and product oriented education, (multiple) task based, and individualised instruction. It enabled student centred learning. Project or problem based education is one of the possible implementation strategies for the future. According to our observations, the wireless laptop class offers the following possibilities to teaching and learning processes:

- Instruction (e.g. different phases in data-analysis using SPSS)
- Presentation and demonstration
    - By the educator (e.g. explain or show topics about Maritime Law)
    - By the student (e.g. presentation of a piece of work on Nazism)
- Drill and practice/exercises (e.g. solving integrals by means of a learning environment, downloading French newspaper articles to analyse parts of speeches)
- Self study (e.g. International Law – consulting, summarising and learning online international reports about refugees)
- Simulation (e.g. Java-applets showing the function of neurotransmitters)
- Communication (e.g. apply newsgroups for online discussions on architecture, send tasks to educator by e-mail, formulate feedback to the instructor in French)

Of course, variation of these approaches is recommended.

Students and educators reported a significant enhancement of communication, collaboration and interaction in the classroom due to the specific characteristics of the wireless laptops: unwired laptops can be rotated, moved and transported easily. The experimental use regularly led to inter- en intragroup interactions. Consequently, the observations showed improvements in motivation, attitude and attention (significantly higher at the start of each laptop activity). Few educators encountered hard- or software problems. Most of the time, all network facilities became available without any problems. Constraints included: limited battery power time, touch pads, smaller keyboard, expensive learning tool, expected health problems (eyes, wrist, bad position).

In fact, only slight differences between a regular notebook class and the unwired version were found. The wireless aspect mainly benefits the freedom of movement, which makes class organisation more flexible.

More comprehensive information will be presented on the Webnet 2001 Conference.

Conclusion and perspectives

The aim of the current study was to identify which educational objectives can be achieved and what kind of problems educators and students encounter using wireless laptops connected to the Internet in the classroom. Technology such as the unwired notebooks can play multiple roles and lead to innovative uses. An overall satisfaction was observed. Therefore, the wireless laptop project will be continued and scaled up next year with a doubled number of participants and expansion to the different campuses of the Free University of Brussels and Vesalius College.

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A Study of the Influences and Barriers to Professional Use of Information and Communication Technology: Teachers vs. Private Sector Employees

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This paper discusses the use of Information and Communication Technology (ICT) among teachers and private sector employees. Various social, psychological and technical aspects were identified as possible determinants of ICT use: innovativeness, i.e. the willingness to adopt new methods and ideas; computer attitudes; perceived organizational barriers; and computer attributes. In January/February 2001, questionnaires were administered to 384 professional ICT users. By means of linear regression modeling, it was demonstrated that computer attributes were the strongest predictor for professional ICT use. The second best predictor was the hindering effect of perceived computer barriers. This poster session will display the development of the research instruments, as well as presentation of the main results.

Computer and Information Literacy (CIL) and Netest
Three Years Later

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Abstract: Computer and Information Literacy (CIL) has been implemented as a graduation requirement at Utah State University for three years. Based on faculty input, six competency areas were defined and tests were developed to evaluate students' ability in each area. Students are required to demonstrate proficiency in each area to satisfy the CIL requirement. In order to facilitate this requirement, specific testing software had to be developed. This software (Netest) is now being used to administer and deliver CIL tests. It is also being used by several departments to administer and deliver course specific tests.

Computer and Information Literacy Defined

The environment in which students learn has significantly changed in the last decade. The ability to use computers to access and present information is now an important basic skill. In 1995, the Utah State Board of Regents, Utah's governing board for higher education, mandated general education articulation between all schools in the system. Part of this articulation involved a uniform requirement for competency in the areas of computer-based information access and manipulation. This articulation process developed what is now termed the computer and information literacy (CIL) requirement. While the basic skills or competencies embodied in this requirement are uniform throughout the State, there is variation in the manner in which these competencies are assessed. In some cases competency it is shown by passing a specific class, and in other cases by passing test s. At USU for uniformity and consistency, this requirement can only be met by passing six computer-based examinations; one for each of the six competencies. These competencies are: Computer Ethics, E-mail, Operating Systems, Document Processing, Information Resources and Spreadsheets. Initially, based on a campus-wide survey, specific skills were outlined in each area and then tests were developed to assess these skills. Students must score 70% on each exam in order to satisfy the CIL requirement.

The CIL requirement has been in place and implemented for three years. It has been a significant undertaking in terms of time, people and financial investment. We have learned much from this experience and are constantly improving our processes.

In the Beginning

In 1994, Utah State University formed a CIL committee consisting of at least one faculty representative from each college. After a campus-wide survey, this committee established the six competencies and tests for each competency. It was decided students could take these tests until 70% competency was shown and would do so during their Freshman year. It was a great idea, but making it happen was the real challenge.

With funding from the central administration a dedicated CIL testing facility was established. With NSF and FIPSE funding, a computer-based testing system was developed to store student data, individual tests, to administer the tests, correct and score the tests, and gather statistics for each test and test question. Early on, it was decided to use the Internet as the means to deliver tests to students.

The Birth of Netest

NSF and FIPSE grants assisted in funding the initial development of the testing system called Netest. Student programmers, supervised by faculty, were hired to develop software modules to meet the various functional requirements for Netest. Because of the diversity of competencies, two types of tests were needed. The first type, what is now called a concept-based test, simply requires that the student show that they have mastery of the concepts underlying the competency by answering a specific set of questions. This type of test is similar to those often delivered by computer-based testing systems. It involves a mix of true/false, multiple choice, matching, sequencing, fill-in-the-blank(s), and essay questions. One of the strengths of Netest is the variety of question categories available for such tests.

The delivery system for the second test category was more challenging to develop. In truth, most of the CIL competencies can only be shown by performing specific tasks. For example, document processing competency is best assessed by requiring the student to perform specific tasks on a document, not answer a series of multiple choice questions about such tasks. For Netest, such tests are called performance-based tests. In this case, Netest delivers two files to the student. One file consists of the operations to be performed, and the other file in the initial state for the test, e.g. an initial document. According to the instructions in the first file, the student modifies the initial state file. When completed, Netest transfers the modified file to the server and removes both files from the client.

While tests can be delivered over the Internet, security is maintained by requiring any such test to be unlocked before it can be taken. In the unlocking process, Netest randomly selects from a database of choices for questions (concept) or task/initial state files (performance) to generate a test for a specific student. Since the unlocking process is controlled, and the tests are administered in a specific lab, security is maintained.

In addition to delivering tests and managing test and student databases, Netest has an extensive capability for test development and editing. Any instructor with a Netest account can develop a test and have it delivered and administered by Netest.

An important capability of any computer-based testing system is that of gathering statistics. Among the statistics gathered are information about each individual test (how many times it was passed the first time, the second time, etc.) and each individual test question (how many times each question was answered correct, incorrect or skipped.) These statistics may indicate a poorly written question, or perhaps one where the given answer was incorrect. Using this information the instructor can make changes and improvements to their test.

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Netest is controlled through three user interfaces, i.e., Manager, Instructor and Student. Managers can add, edit or delete Managers, Instructors and Students. They can unlock specific tests at the request of an instructor or student (depending on protocol). Instructors can develop, change and delete tests they "own". They can also manually grade performance tests and update a student's test score. Students can take tests and view their personal statistics.

The Netest paradigm is also useful in other testing environments. Netest includes a model of a "class". A class is made up of students. Tests belong to classes. When a student views his/her statistics, the test scores are shown for the classes in which the student is enrolled. This allows tests to be developed for several classes with students only able to access the information belonging to their classes.

Netest Today

Because of the flexibility of Netest and the fact that it is able to run on the Internet, other areas of the university have become interested in using this product. Netest is now being used to administer tests for the CIL requirement as well as the History CLEP test and several other Business, Computer Science and Agriculture tests.

Although, there are many testing programs available today, Netest is unique since it includes performance based testing capabilities. This type of test must be hand graded at this time, but we are working to develop an algorithm to automate the grading of performance-based tests.

CIL was driving force for the development of Netest. For three years changes were made in Netest because of the dynamic nature of CIL. That has not changed. Programmers are still employed to make revisions as necessary, but now CIL is not the driving force; the many courses using Netest to administer their exams are suggesting changes, usually beginning with the statement, "Wouldn't it be great if Netest could ...." Based on the past, we anticipate that Netest will continue to change and evolve.

Details of CIL

For CIL testing a secure testing environment was needed. For this purpose, the CIL testing lab was constructed, consisting of 24 Pentium based computers using the Windows 98 operating system. The software on these machines include the Corel Suite and Office 2000. Each computer has access to the Internet and the University VMS system. The lab is staffed with consultants who unlock tests and answer CIL related questions, and technicians who set up student accounts and maintain the computers in the lab. The lab is open from 8:00 a.m.- 8:00 p.m. Monday through Friday and 12:30 p.m. – 4:30 p.m. on Saturday.

To fill the gap between what was required to pass the CIL tests and what students actually can do, on-line, interactive teaching tutorials were created for many of the tests. Macromedia's Authorware was used to develop and deliver these tutorials. Each tutorial included a practice CIL test so students can pretest their skill level. These practice tests are self-checked by students. If students need more explanation as they practice, they can refer back to the tutorial by clicking on a button in the practice section. This button returns them to the tutorial section explaining the skill they are asked to show. This allows students to acquire and assess all of the skills needed to pass the CIL tests before they actually take the tests.

Additionally, short courses were designed to provide a live instructor to teach students the specific CIL skills. These courses provide instruction as well as practice for each test. They are taught once a week and one competency is taught per week. Any student registered to take the CIL exams may attend the short courses.

The full CIL requirement is outlined on the USU CIL Web Page (http://cilserver.ser.usu.edu/) as well as procedures for taking each CIL test. This web page links to the teaching modules and other relevant information. Students can study this information from anywhere and then come into the lab to take the tests. The lab is used to ensure test security.

Utah State University has several extension sites throughout the state. Some of them are more than 200 miles away. Students who attend USU at one of these sites also need to take the CIL tests. Since the Internet is the means where these tests are given, it is simple to have these sites implement procedures to give the CIL tests through the Netest system.

CIL – Three Years Running

In the three years since its inception, over 7,000 students have taken one or more of the CIL tests. Both the CIL requirement, and Netest are dynamic, and undergoing assessment and change. As part of the CIL laboratory three to four students work half-time making changes and updates to Netest. This has been an excellent opportunity for these students to gain real-world software development and engineering experience.

The following table represents passing/attempt statistics to date for the CIL tests:

	Passed First Attempt	Passed Second Attempt	Passed Third Attempt
Operating Systems	85%	79%	78%
Ethics	60%	54%	45%
Document	95%	96%	97%
Spreadsheets	95%	85%	73%
Information Resources	83%	89%	86%

Table 1: CIL Test Pass/Attempt Statistics 1998-2001

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Because of the dynamic nature of any technology related skill, it is necessary to frequently assess the utility of those skills. In March of 2001, students, faculty, and advisers were surveyed concerning the current requirements, goals, and implementation of the CIL requirement.

The survey showed that faculty view the CIL requirement positively – 89% support it while only 11% oppose it. They do not think any of the current competencies are obsolete but would like to add several, including presentation software, graphics and web page development.

Academic advisors are satisfied with the CIL requirement and tests – 71% satisfied and 22% not satisfied (7% also replied N/A). They also feel the students they advise are satisfied with the requirement– 64% satisfied and 25% not satisfied (11% replied N/A).

Students were asked which of the CIL competencies were being used in their courses at USU. Most (97%) students are using E-mail, 82% are using the Internet, 82% are using Operating Systems and 68% are using Document Processing. Only 36% are using spreadsheets and only 33% reported "using" Computer Ethics. It was interesting to note that 81% of the professors are using a web page to communicate class information, thus requiring Internet usage to be an integral part of the course.

Future of Computer and Information Literacy and Netest

There are over 4000 new freshmen every year at Utah State. So far, a little less than half have taken at least one of the CIL tests. It remains a significant challenge to convince students to meet the CIL requirement early in their academic career. Part of the problem lies in the fact that some students are not aware of the requirement. Also, the fact that meeting the requirement is not tied directly to a class or classes, tends to cause students to put off meeting the requirement. In the next few years the number of students who take the CIL tests will increase more rapidly because of the "glut" of procrastinators who now need to graduate.

Netest is still changing as well as the processes involved. It has been a significant undertaking to develop the Netest program — a program which administers accounts, tests, and people, and provides global access to this system via the Internet. It is difficult to describe in a few words the capability of Netest. A demonstration is more appropriate. Netest is definitely worthy of being shared with others. Other colleges in the state of Utah are looking at the possibility of using Netest to facilitate their Computer Literacy Requirements.

As the world of computers changes so will CIL. The CIL committee meets each semester to review the competencies and to determine if additional competencies should be added and which of the current ones are obsolete. Currently, the committee is considering adding Presentations Software, Graphics – scanning and downloading/capturing, and/or Web Page Development to the CIL tests. However, adding three modules without taking away any would be significant additional burden to students. There is a possibility of having exams required for students depending on which college/department they are enrolled.

Lessons Learned

CIL is USU's first campus wide requirement assessed by a single set of tests. The normal college implementation scheme for such a requirement has been to allow departments to offer a course(s) which, if passed, meets the requirement. Maintaining content uniformity in such classes is always difficult, if not impossible. USU's approach, while we feel is more pedagogically sound, brings its own challenges. It is only because of support from the administration that classes have not been developed to meet (replace) the requirement. While there are some classes that teach to the CIL requirements, students in such classes must pass the same set of tests as those not taking a class. While the CIL requirement will evolve at USU, it is also apparent that it will likely migrate. Discussions are now underway with Public Education in Utah to make CIL or some version thereof, a requirement for all high school graduates. Hopefully, a high school based CIL requirement will also be test-based and centralized like USU's CIL requirement.

Implementation of a digital learning environment: The real results

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Abstract: At the University of Twente, a course management system called "TeleTOP" has been implemented in all faculties the last 1.5 years. The paper describes the TeleTOP-system and the implementation process. To find out how teachers use their course environments in education, an analysis was made of 60 course environments. Results show, that these course environments are mainly used for the dissemination of information and less for interactive communication. Also, course environments help students prepare for learning, orientate on course content and practice, but are rarely used for giving feedback, monitoring and assessment. In the last section, tips and recommendations are given for improving the use of course environments.

Introduction

Since the introduction of the world wide web, the web has been used in many ways to support education. The last three years, one particular use of the web has been very popular; the course management system. Different tools or platforms have been developed and implemented in universities all over the world. At the university of Twente, a choice was made for a home-made solution; the TeleTOP system. After successful use in one faculty, the university-wide implementation of TeleTOP started in the summer of 1999. Now, after 1.5 years of hard work, it is time to see what the results are.

In this article, we present the results that can be achieved with the implementation of a course management system in a relatively short period of time. Also, by taking a closer look at the first implementation results we want to research what the "real" results are; to what extent are the implemented course environment really used in education? The third and most important goal of our research is to give examples and guidelines that instructional designers and teachers can use to improve the use of course environments in education.

TeleTOP, the Course Management System of the University of Twente

As said in the introduction, TeleTOP is the course management system of the University of Twente. The goal of this system is to support and facilitate the learning process of students by supplying them with all the information they need to follow a course and with several options for communication with teachers and fellow students through the world wide web. As the University of Twente is a campus-based university, the course management system is used mainly to support on-campus learning.

TeleTOP was developed in the beginning of the year 1998 at the Faculty of Educational Technology (Tielemans & Collis, 1999). The most important demands for the system were, that it should be consistent in terms of lay-out and structure, very easy to work with for both teachers and students, accessible through the WWW without any extra system requirements and based on a database-system. According to these wishes, the development took place at the faculty of Educational Technology. Later in 1998 the Faculty started using the system in its courses.

Because of the successful implementation at the faculty of Educational technology and also because of the lack flexibility in existing systems, the university board decided in 1999 to choose TeleTOP as course management system for the entire university. In the year 2000 the university wide implementation started on a voluntary basis. All technical facilities where supplied by the university and a team of instructional designers was available for educational support, but it was up to the faculties to decide if, and to what extent, they wanted to join the TeleTOP implementation.

Like most course management systems, TeleTOP is a course based system. For every course, an environment can be created. The teacher can choose which functionalities he or she wants to use for his or her course. Figure 1 gives a schematic representation of the TeleTOP system.

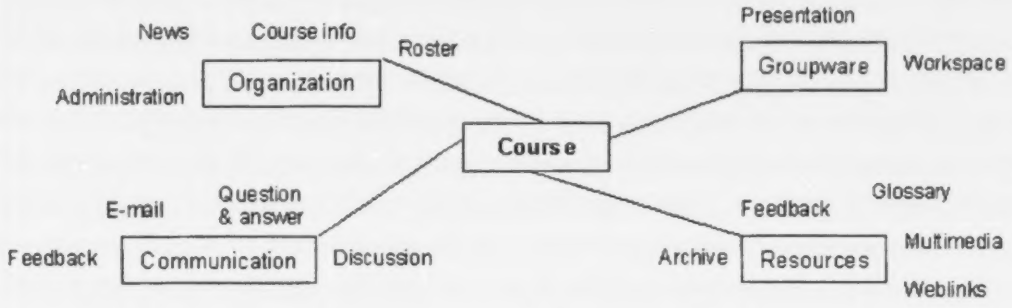

Figure 1: Schematic representation of TeleTOP

The core of every TeleTOP environment is "The Roster" (course schedule). This roster gives the student a very clear overview of the activities and materials in the course. In each TeleTOP site, the roster consists of 3 columns that tell the student what to do *before, during and after a session* (see figure 2. The TeleTOP Roster). By clicking on a link in one of the roster cells, the student is taken to a page were he or she can find more detailed information, study materials and assignments related to that particular activity.

Roster

00		Before the session	Date and location	During the session	After the session	
01		Purchase CD from TDG Secretary	Dec 4 1814 MS	Introduction to Planning and Management	Do exercise attached	
02		Read Unit 3-1, 3-2, 3-3	Dec 5 1845 MS	The Project Cycle		
03		Read Unit 3-1, 3-2, 3-3	Dec 11 1814 MS	The Project Cycle		

Figure 2: The TeleTOP Roster

Implementation strategy and results

The way TeleTOP has been implemented at the various faculties differs. In general we can distinguish three strategies used for the implementation of TeleTOP:

1. Overall strategy: TeleTOP is implemented in all study phases of the program and all teachers are expected to use TeleTOP to support their courses;
2. Phased strategy: The implementation starts in the first year of the program. Then, the system is gradually implemented into the other study-phases;
3. Pilot strategy: The faculty starts with a few pilot courses. When the pilots prove to be successful, the implementation is expanded to one of the other strategies.

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The implementation strategy is not prescribed by the university board, but is chosen by the faculty itself. For each faculty an instructional designer of the DINKEL Institute is available for support during the implementation process.

As soon as the faculty board has decided to use TeleTOP in it's education and a choice for an implementation strategy is chosen, a demonstration of TeleTOP is organized for all teachers that will be involved. For the acceptance of TeleTOP by teachers it is proven to be important, that during this introduction, the faculty-director states clearly why and in what way TeleTOP will be used in the Faculty.

After this plenary demonstration, in which a quick overview is given of the TeleTOP system and it's possibilities, individual one-hour appointments are made with the teachers. These appointments can be divided in a technical instruction of TeleTOP and advice about the didactic use of the system. During this appointment the instructional designer and the teacher take a closer look at the course and decide which functionalities of TeleTOP (described in figure 1, §2.1.3) will be most suitable to support the course. After this one-hour introduction, the teacher is able to start filling the course environment with information and materials. For further support during the use of TeleTOP in their course teachers can contact the educational consultant, or take a look at the TeleTOP-supportsite (available on the WWW). This supportsite offers teachers technical as well as didactic tips for the use of TeleTOP in their course.

Right now, after 1.5 years of implementation, more than 400 courses offered at the University of Twente have been implemented into the TeleTOP system. At this moment, all faculties have decided to participate in the TeleTOP implementation process.

The Research

Looking at the sections above, one might conclude, that the implementation of the TeleTOP system has been very successful until now. In one and a half year, more than 400 courses were implemented in TeleTOP and most of the teachers and students at this university are working with the system. However, what really matters is not how many course environments have been created and how many people are involved. If we really want to know how successful the implementation was, we have to look at what is happening inside these course environments to support the learning process. To find out what the real implementation results are, these are the research questions to be answered:

a. For which goal(s) are the course environments used?
b. How do the course environments support the learning processes of the students?

To answer the first research question we identified which of the following three types of interactions were found in course environments;

- Information supply; the teacher supplies the students with information. This can be textual, but also graphical information, video and audio, etc. Information supply can be divided into two sub-categories, namely:
  - *Supply of organizational information*: e.g. the course schedule tells the students when and where the classes take place.
  - *Supply of content-related information*: e.g. in the course environment, the students can find documents in which quantum-mechanics are explained.
- Communication; the teacher communicates with students in an interactive way. This can for example be the answering of questions students send in, discussion statements, etc. Communication can be divided into two sub-categories:
  - *Organizational communication*: e.g. the student asks the teacher when the assessment will take place.
  - *Content-related communication*: e.g. the students have an online discussion about the solution of a math problem.
- Course work; students work on products such as reports, presentation, etc, within the course environment. This last category can be divided into:
  - *Individual course work*; one student works on a product and hands it in individually.
  - *Group-based course work*; students work together as a group on a project, report or something else, supported by the course environment and hand in their product as a group.

The instrument used to answer the second question, is an existing educational model, based on *instructional functions* (Terlouw, 1997). Instructional functions describe which activities should take place in education to ensure that the desired learning processes take place.

The following main functions and sub-functions are defined:

- *Preparatory functions:* motivating, connecting to prerequisite knowledge, giving insight in learning goals, planning the learning process
- *Executive functions:* orientation on knowledge, orientation on skills and attitude, practice
- *Regulative functions:* monitoring progress and effort, feedback during practice, assessment, feedback after assessment

The instructional functions mentioned above give no information about the medium or activity in which these are fulfilled. Within a course, some of these functions will be fulfilled by the teacher (e.g. the teacher gives the students feedback on their work), some by textual materials (e.g. the book lets the student orientate on knowledge), etc. A course management system like TeleTOP in itself cannot fulfill any instructional functions. What we would like to know is which of these instructional functions are fulfilled *through* the TeleTOP course environment, using the environment as a carrier of information and tools.

Because of time constraints, it was not possible to analyze all courses in TeleTOP. For this reason, a selection procedure was made to select 15 % of the existing TeleTOP environments. 10 faculties participated in the research. From each faculty, we selected 6 sites, which brings the total number of analyzed course environments at 60 (= 15% of 400). The course environments were randomly selected on their unique course code.

Results

In table one, we see in the first column the number of course environments (n = 60) in which a certain goal was addressed. In the second column, we see the same data in percentages.

Goal	# of course environments	% of course environments
Supply of organizational information (OI)	60	100.0
Supply of content-related information (CI)	50	83.3
Organizational communication (OC)	15	25.0
Content-related communication (CC)	9	15.0
Individual course work (IW)	25	41.7
Groupbased course work (GW)	12	20.0

Table 1: Goals for using course environments

In table two, we can see how the instructional functions were fulfilled through the 60 analyzed course environments. In column one, we can see, in *what number* of sites the *sub-functions* were found. In column two, in *what percentage* of the 60 analyzed sites *at least one of the sub-functions* was addressed.

Instructional functions	# functions	% sites
Preparatory functions		
Giving insight in learning goals	37x	
Motivating	29x	
Connecting to prerequisite knowledge	15x	
Planning the learning process	12x	
Percentage of sites in which at least one of the preparatory functions was found		*81.67*
Executive functions		
Orientation on knowledge	48x	
Orientation on skills and attitude	19x	
Practicing	37x	
Percentage of sites in which at least one of the executive functions was found		*88.33*

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Regulative functions		
Giving guidance / monitoring progress and effort	02x	
Feedback during practice	21x	
Assessment	03x	
Feedback after assessment	01x	
Percentage of sites in which at least one of the regulative functions was found		*20.00*

Table 2: Instructional functions fulfilled through the TeleTOP course environments

Conclusions

Looking at our research questions and the results, we can draw the following conclusions:

For which goal(s) are the course environments used?

In the course environments we analyzed, the emphasis is clearly on the dissemination of information from the teacher to the students. This information is not only organizational but also content-related. In the TeleTOP environments, teachers offer students lecture notes, articles, etc. This matches with the results of the university-wide evaluation of TeleTOP (Peters & Visser, 2001) where students indicate, that the most important benefit of TeleTOP is, that it provides access to information and study materials. In contrast to the first conclusion, not so many course environments are used to support two-way interaction between teachers and students. Content-related communication seems even more difficult to realize. This also corresponds with the results of the TeleTOP evaluation (Peters & Visser, 2001) in which teachers indicate that they do not perceive a functionality like discussion as very useful, because the discussions are seldom content-related and often not very serious. However, with this conclusion, we have to add, that there could be a lot of communication through lectures and e-mail, which is not visible in the TeleTOP environments. Finally, if a course environment is used to support course work, the emphasis is mostly on individual course work and less on group-work.

How do the course environments support the learning processes of the students?

The results show us, that TeleTOP environments are primarily used by teachers to prepare students for learning and helping them to practice and orientate on course content. More attention could be given to helping the students plan their learning and connecting to prerequisite knowledge. Remarkable is, that the amount of guidance, monitoring and feedback is still very poor. Even when students are asked to hand in course work, feedback is not often given through TeleTOP, but face to face or sometimes not at all. Finally, in almost all cases, assessment seems to take place outside of the course environments.

From this research we conclude, that although a lot of activity and dissemination of information is taking place in TeleTOP, some possibilities of the system are not (or not sufficiently) exploited yet. During the first 1.5 years of the TeleTOP implementation, teachers had to put a lot of time and effort in getting to know the system and making their paper-materials available in a digital format. An earlier evaluation study at the Faculty of Educational Technology (Collis & Messing, 2001) shows the same results. Now that this first implementation round has been done, it is time to move to a second round in which the emphasis is on didactics and online interaction. Together with educational consultants, teachers can find ways to come to a better use of their course environments.

Tips and recommendations

In order to elaborate on our conclusions, we conclude with tips and recommendations that teachers and educational designers can use to improve the use of learning environments. Although this research was fully based on the situation at the University of Twente, we feel that the tips and recommendations here could also be used at other educational institutions using a course management system to support their courses.

a. Alternatives for content-related information: content related information in a course environment often exists of lectures, notes or articles. In addition to this, as a teacher, you can:
   - make a link from the course environment to online scientific magazines
   - give a list of relevant, fun and interesting websites students can use while making their assignments
   - show examples of excellent course work from students of previous study-years

- ask students to search for content-related information and collect this in the course environment

b. To stimulate two-way communication between teacher and students, one can:
   - tell students how often you are going to answer questions that students post in the course environments, so students know when they can expect an answer or reaction
   - ask one student to fulfill the role of moderator in an online discussion or ask a student to actively stimulate the discussion by putting in statements
   - stimulate the use of discussion by putting the first items in yourself and invite students to join
   - stimulate students to ask questions, by putting a few frequently asked questions and answers from last year's group in the course environment

c. The problem with content-related communication often is, that it doesn't occur because it is a separate activity that is not integrated in the course. Some recommendations to stimulate this:
   - The teacher plays an active role in the communication
   - Clear assignments in the course environments tell the students what the topic is and what contribution is expected of them
   - Participation is assessed and rewarded
   - During the face-to-face meetings, the outcomes of the online communications are used in one of the activities

d. There are several ways to motivate students in a course environment:
   - ask students to prepare questions for the next lecture and post them in the course environment
   - give students an active role in the development of the course environment, by making them (as part of a course assignment) deliver content for the site
   - clearly state what intentions you have with the use of the course environment in the course

e. Helping students plan their learning process
   - In the course schedule, instead of only indicating when the lecture are and what assignments have to be made, also indicate how much time a student should spend on each course activity

f. The problem with feedback often is, that it is very time consuming to give written feedback to each student in a course environment. Some alternatives for face-to-face feedback:
   - provide a model-answer, so students can compare their answers to this example
   - use peer review; make students assess each other's work
   - make practice assignments optional; students who really want to practice will make the assignments and receive feedback. Students who feel they don't need the practice can skip the assignments.

Final note: To stimulate teachers to a better use of their course environments, it is essential, that practical tips and recommendations are disseminated into the faculties. Below, we list a few of the many ways to do this:

- Build a support environment in which teachers can find didactic tips and good practice examples.
- Give teachers access to the course environments of their colleagues, so they can see how other teachers fill their course environments and learn from each other's successes and failures.
- Make a list of 'example course environments' available for the whole university on a prominent place and explain to teachers why these are considered 'good examples'.
- Organize didactic workshops where teachers can work on improving their course environments with help of an educational consultant.

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Using the Dynamic Adaptation Technique of Presentation on the WEB

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Abstract: Nowadays, the problem of presentation adaptation to user has been studied under the conditional text technique (ITEM/IP, C-Book, De Bra's adaptive course on Hypertext) or providing alerts about the state of a web page (ELM-ART, AST y Interbook).
In our case, we have considered the adaptation of the media (image, sound, animation and text) according to the student goals and the stored information of the student model.
In this paper, we describe the design and implementation of a generator program with dynamic update of content as a component of a ITS to diagnostic and treatment the Dyslexia in the Spanish language.
ITS design is based on Web technologies. So, we have added to the traditional model several modules that can adapt and modify dynamically the system behaviour. Therefore, we had designed and developed a generator program of presentation that handle a set of templates related to the activities that the system have to show.

1. Introduction

Web-based courses and other educational applications have been made available on the Web within the last five years. The problem is that most of them are nothing more than a network of static hypertext pages. A challenging research goal is the development of advanced Web-based educational applications that can offer some amount of adaptivity and intelligence. Adaptive and intelligent technologies usually could be further dissected into finer grain techniques and methods, which corresponds to different variations of this functionality and different ways of its implementation [1]. In this work, we will focus on the *adaptive presentation technology* (APT). APT objective is to adapt the content of an web page to the student goals, knowledge or any other information stored in the student model. The pages in the systems with adaptive presentation are not static. To each user in particular, the pages are generated adaptively or assembled from pieces.

To provide the adaptation, the techniques currently used are: "conditional text" (ITEM/IP, C-Book, De Bra's adaptive course on Hypertext), and to show "adaptive warnings messages" about the student knowledge state into a page (ELM -ART, AST). But, this techniques do not consider the media adaptation.

Our objective is to create dynamically the activities presentation that the pupil has to realise taken into account the totality of media that the system will show (sounds, images, words, sentences, explanations, feedbacks, ...), the student learning characteristics and the knowledge state. For these reason, we have follow a methodology of media and modalities adaptation to define the components of our adaptation.

We have organize this papers as follow: firstly, we describe the methodology used, then the components of the adaptation and finally, how we have modelled and developed the generator program.

2. Intelligent Multimedia Interface Design

2.1 Media and Modalities Adaptation Methodology

Intelligent Multimedia Presentation Systems (IMMPS) [2,3] has been defined as Knowledge Based Systems (KBS). IMMPS uses their knowledge base to adapt dynamically and to take design decisions on real time according on the user-computer interaction requirements. [4].

The process of adaptability is characterized with several attributes, which are not clearly delimited [5].

- *Determinants*: are factors that guide the adaptation process (i.e., adaptation based on the users characteristics, kinds of task or interaction, etc.);
- *Constituents*: are interaction aspects that are adapted (i.e. content, presentation primitives as interaction techniques, media or modalities);
- *Objectives:* are particular goals that guided the adaptation process (i.e. to minimize errors numbers, to optimise the efficiency and efficiency, etc.);
- *Rules:* Guides the process of instantiation of adaptation constituents according to the state of adaptation determinants.

The adaptation process is carried out trough the selection of constituents based on the determinants using the adaptation rules.

a) Determinants

In order to this methodology, for design the adaptation in our system we have categorized the determinants in two spaces:

a) Interaction Context Space (IC)
b) Information Space (I)

More specifically, the IC space are building with the follows determinants:

- *Student Model:* formed by a perfil (personal characteristic of student) and records (variables about the learning evolution).
- *Teaching strategies:* has the knowledge about the plan of didactic sequence, and are based on a set of rules that permit adjust the system to the student according to the learning goals.

On I space, determinant is the convenience level about media use. We have designed different modules to evaluation and treatment according to the presented problems in each dyslexia type. The follows modules were defined: syntactic, audible discrimination, levels of phonologic awareness, knowledge of letters and lexemes and suffixes. The nature of each task depend of module and stimulus presented into the module. Text can be presented as visual or audible way, with diverse styles (script, bold, ...), in a graphic way, with sounds, etc. By the other hand, graphics and animations can be presented isolated or in a time sequence joined the audio. For instance, in the case of audible discrimination module, we must use the audible media that have more incidences in the task (words, couple of words, syllables, etc.).

b) Constituents

Into this methodology, we are going to define the adaptation constituents:

- *Information presentation*: the information is presented according to the kind of dyslexia and the level of routes affectation.
- *Task simplification:* is the process where complements object are deleted, options are reduced,....
- *Visual components of presentation:* phrases, words, images and animations are presented in accordance with their level of incidence in the kind of task that the pupil has to do and/or the type of errors committed.
- *Audible components of presentation:* as the visual components, phrases, words, feedbacks and explanations are presented in relation to their level of incidence in the kind of task that the pupil has to do and/or the type of errors achieved.

c) Objectives

Our goals are:

-In technical terms:

- *Easy scalability and system reuse*
- *Decreasing computing resources cost*

For these reason, we have designed the system with a scalable architecture. So, with this architecture we can represent dynamically the media and the system can increase easily in media and stimulus with a simple addition of their references and relations in the database.

-In pedagogical terms:

- Increasing student attention and motivation.
- Encouraging the significant learning through a right combination of media and modalities

Consequently, to achieve the goals, we have defined the instruction system with a set of components. Components are several kinds of tasks and events for encourage the attention, motivation and learning process during the program execution.[6]

d) Rules

Rules define the allocation of constituents to determinants taking into account the level of satisfaction of the adaptation goals.

Some of the rules that we have defined to our system are:

- If the user has phonologic dyslexia, then show pseudo words or familiar words in the evaluation.
- If user has phonologic dyslexia, then show irregular words and introduce pseudo words or familiar words gradually into the treatment.
- If user has superficial dyslexia, then show irregular words in the evaluation.
- If user has superficial dyslexia, then show pseudo words or familiar words and introduce gradually into the treatment irregular words
- If user has superficial dyslexia then enlarge gradually words long.
- If user has superficial dyslexia then enlarge gradually words complexity.
- If user do not response in a time t to the asked interaction i, then call the attention of the pupil by a pedagogical agent or an animation.
- Be DO = { $d_{o1}, d_{o2}, \ldots, d_{ox}$} the set of pictures related with the o object, if the object o is presented with the related picture d_o then the next visual presentation object must change for the next related picture d_x.
- Be IO = { $i_{o1}, i_{o2}, \ldots, i_{ox}$} the set of images associated to the o object, and be o={*word, letter, sentence*}, if the student has made an error related to the object o, it is presented with its associated image i_o in light up modality.
- If user has committed a error during the treatment, run the feedback using the agent, with the explanation related to error type produced
- If user makes error n times, decrease complexity task.
- If user makes error n maximum times, review the requisites previous and go to another task related of less complexity.
- If user makes a task satisfactorily, run the positive feedback using pedagogical agent and go to next task in order of complexity.
- If is the first presentation of a task, run the demonstration, merging in the time the sequence of audible and visual media with the agent execution.
- .....

In the following section, we will describe how the system has been designed and developed to realize the adaptation process of media and modalities in the multimedia interface.

2.2 System Modelling

As we have mentioned before, we have different modules of evaluation and treatment of dyslexia. A module that measure the latency time in the reading of words determines type of dyslexia presented. Then, we need determine what are the specific problems of each pupil in each type of dyslexia. For this reason, the pupil has to resolve all task proposed by the system in the evaluation for each module, according to the presented problems in each dyslexia type. Afterwards, the modules of treatment are activated in the difficulty levels that match to the problems detected in the evaluation.

Regarding to the tasks presented, our system has an inference engine responsible of monitoring the user answers to the interactions asked. According to these responses and the goals satisfaction level, the system determines the instantiation of the adaptation constituents.

But, depending on the kind of decision we have stored the rules in the interface and other in the inference engine. For instance, the inference engine determines the next task and the media (pictures, phonemes, sentences, feedbacks, etc.) that would be used in the activities presentations according to the stored data in the student model (perfil and records). These specifications are stored in the database. Interface reads these database specifications and decides when and how uses the media according to users responses in the task. Then, the basic unit of the inference module is a task. Presentations are components of a task and are the basic units for interface.

Developed prototype [7] allows the presentation adaptation of tasks to the individual characteristics of student through a program that generates dynamically activities and builds the presentation more adjustable to the learning style of the pupil.

How is produced the adaptation? In the database we have all the audible and visual media that the system can use and the relations with the contents to teach. Interface decides in each case, what and how merge the media according to the instructional objective and the data about previous learning of student.

In this sense, the system works in the following way: starting off student records, the contents that the pupil has to acquire are determined by the treatment goals to this particular student. What and how the activity will be showed to acquire the fixed objective will be determined by the student perfil.

Fundamental objects in the implementation of system are: objective, task, activity and structure.

1.- Object *objective* has instances of *task* object by an aggregation type relation (instances of the *task* exists although *objective* object has been deleted). *Objective* object allows us to know what exercises the student must do to advance in the search tree.

2.- Each instance of the object *task* will be a *task1, task2,....., taskN* object. Instances are formed by *activity* objects with a composition type relation (if *taskN* does not exist, all activities associated are deleted). An instance of task tells us about how the information is presented to the user. So, an instance has an aggregation type relation with the *structure* object.

3.- A*ctivity* object can inherit attributes of different classes of activities. Classes of activities can be: *presentation, explanation, evaluation and motivation.* Its will give rules of behaviour to the *activity.*

4.- *Structure* object is a template that indicates to multimedia interface what and how must show the media in the screen.

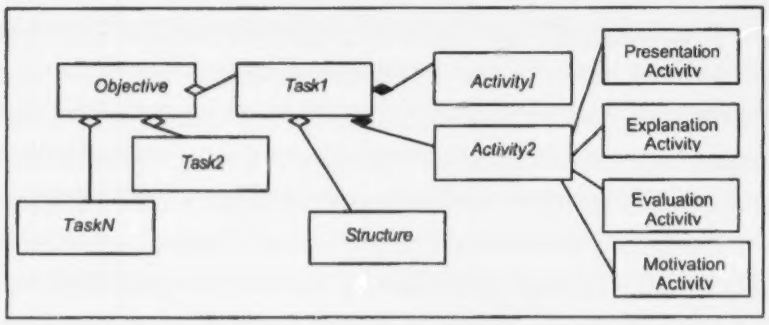

Figure 1. Modelling of objects

2.3 Implementation

In the implementation of prototype we have used: database tools (MySQL) merged with tools for development of courses on the Web (Macromedia Flash 5, Macromedia Dreamweaver

Ultradev 4, Coursebuilder), for the production of visual media (Macromedia Fireworks, Corel Draw, Corel Photo Paint) and finally, for the generation of the inference engine (CLIPS).

Generator program of presentations has been implemented as a set of templates linked with the database. A template shows the task structure where is determined the interaction types, containers of texts, images, sounds and animation, and input/output variables.

In synthesis, the interface is a combination of dynamic pages ASP connected to a database through ODBC where the content of a presentation is a result of a SQL sentence.

Process of communication between the inference engine and the interface is carried out by the database.

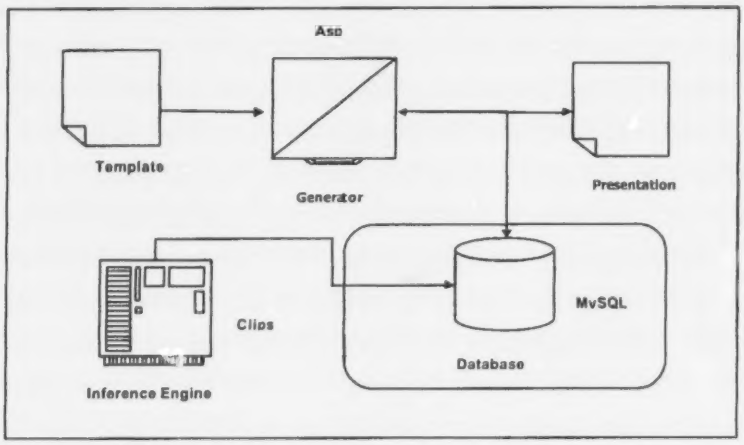

Figure 2. Architecture of System

3. Conclusions

In this paper we have described the design, modelling and implementation of an intelligent multimedia interface that can adapt media and modalities of a presentation according to the users answers.

For design the interface we have used methodologies of media and modalities adaptation. These methodologies were very useful in the stages of declaration and definition of adaptation components.

For implementation we have employed tools based on WEB. Firstly, we started to implementation with Flash 5 y Generator, but we have found problems with the integration of Microsoft Agents. For this reason, we must search others tools that permit include all of our systems components. So, we decided use Macromedia Ultradev 4 that allows us an easy integration with the database and agents as ActiveX.

Currently, we are working in the development of system, because we have implemented all evaluation modules but only one treatment module. The system will be carried to schools on September in the next course for start with the process of validation and experimentation by the psychologists, members of the group of research. At the same time, we will continue with the implementation of the rest of modules.

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5. Acknowledges

We are indebted to Dr. Juan E. Jiménez González of Department of "Psicología Educativa, Evolutiva y Psicobiología" of La Laguna' s Univerity and his group of researchers, members of Sicole Project, for their contribution.

[i] According to Colheart's double route model, there are three kinds of dyslexia:

- Phonologic: reading is produced by the visual route and is characterized by a selective deficit with pseudo words or unfamiliar words.
- Superficial: reading always is produced by the phonologic route and is characterized by a selective deficit with irregular words, but is possible to read pseudo words and unfamiliar words. Because the reading depends on the phonologic route, the pupils have difficulties with larges and complex words.
- Mixed: there are problems regarding to the previous two subtypes of dyslexia.

Each dyslexia type can present different levels of affectation, empathising or minimizing the affectation levels in some of the problems presented. So, dyslexia types not forms groups totally closed.

Challenges of Creating an Online Doctoral Program:
Panel Discussion of the Trials and Success of the Ohio State NonTraditional Doctor of Pharmacy Program

Presenters:

Dennis Mungall, Director of Virtual Education
Cable Green, Director of Educational Technology
Barbara Skunza, Program Director

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ABSTRACT

An increasingly large number of colleges and universities are at least exploring the feasibility of, if not rushing headfirst into, offering credit-bearing courses on the Web. As the result of the combination of several factors, colleges and universitics are being confronted with the need to make significant changes in the ways in which they function academically and administratively. The increasingly diverse demographics of the student population, the evolving perceived role of education, and the escalating costs for both the institution and the student all contribute to this evolutionary pressure.

In response to these challenges, numerous schools, both in this country and internationally, are actively investigating, and implementing, non-traditional academic programs. The College of Pharmacy launched the first online degree-granting program, the NonTraditional Doctor of Pharmacy Program , at the Ohio State University in January, 2001. Although there are numerous competitive advantages to a web-based course delivery system, there are an equal number of issues that must be addressed.

This presentation explores three critical issues any program must address before launching a non-traditional online degree program: **(1)** learner orientation, **(2)** translating the techniques for facilitating and monitoring student learning that have been developed for a classroom-based delivery into a web-based environment and **(3)** integrating the new program into existing University infrastructure.

Student Orientation (Cable Green)

Cable Green is the Director of Educational Technology in the College of Pharmacy, Clinical Assistant Professor in the Division of Pharmacy Practice and Administration, and Doctoral student in the School of Journalism and Communication at The Ohio State University. He studies how collaborative teaching pedagogies and problem-solving strategies can be used in conjunction with technology to create informating on-line learning spaces. Cable is active in designing, developing, supporting and evaluating on-line distance learning programs.

Web Site: http://jac.sbs.ohio-state.edu/cable/

Abstract:

Virtual universities are changing the landscape of higher education. Without the proper student orientation to multiple online education issues, students are left with traditional tools in a non-traditional environment. Aggressive student orientation must include an introduction to technological infrastructure, pedagogical issues, communication skills, and study and time management skills for an on-line community of learners to succeed.

There are fundamental pedagogical differences between traditional and on-line classrooms. While one can argue learning online is no different than a traditional classroom, the reliance on technology for the delivery of instruction changes the process by which instruction is delivered. Therefore, the incorporation an appropriate on-line learner orientation, pedagogical methodologies and strategies in a Web-based learning environment can aid in helping both student and teacher to adapt and succeed in this new learning environment.

To meet these challenges, this part of the presentation will provide a comprehensive student orientation including an introduction to technological infrastructure, pedagogical issues, communication skills, and study and time management skills for an on-line community of learners. The student orientation includes a wealth of information the novice online learner will need to succeed including: differences between on-line and traditional classes, hardware and software specifications, Internet access, configuring software, learning Internet tool sets (i.e., E-mail, web browsers, chat, bulletin boards, etc.), hints on how to succeed with on-line courses, how to create the right on-line study environment, citing web resources, and on-line codes of conduct.

Guidelines for Developing an Online Student Orientation for a Virtual University

Establishing the objectives for a web site

- Understanding your objectives will help determine the content and organization of your web site.
- While developing your web site, keep in mind your objectives when making web design decisions.

Keep the audience in mind

- How familiar are your students with the Internet?
- Will students be accessing the web site from campus via Ethernet or from off-campus via a modem?
- What type of computers or web browsers will your students be using?

Organization

- Make your web site easy to navigate
- Organize your content into logical sections
- Create a consistent style (possibly develop a template for your web pages)
- Considering limiting the layout of your web pages to the dimensions of the average computer screen.

***Weaving a Virtual Education Web*: Creation of an Online, Non Traditional Doctor of Pharmacy Program (Dennis Mungall)**

Dennis Mungall, Pharm.D. (**http://members.aol.com/thertch/resume.htm**)
is the Director of the Non Traditional Doctor of Pharmacy Program in the College of Pharmacy and Associate Professor in the Division of Pharmacy Practice and Administration at The Ohio State University. He has been actively involved testing and development of bedside medical decision tools, multimedia teaching, and clinical pharmacology training for several years.

Abstract:

The presentation will focus on the following areas: Factors to consider when weaving your virtual education program, consistency of course design, faculty course development training and responsibilities, creating the "on campus" feel , student training, recruitment and, supportive resources: residents, fellows, technology experts. Other areas to be discussed include: assuring the quality/outcome of a non-traditional Doctor of Pharmacy when compared to the residential doctor of pharmacy program, creating a clinical "toolbox" for the NTPD: transferring clinical expertise via virtual clinics and finally intellectual property issues.

1. Purpose
    a. Review online curriculum approaches currently used in pharmacy education on the web
    b. Review the implementation strategy at OSU for the online NTPD
    c. Discuss the possible outcomes of a Web based program
    d. Discuss impact on faculty, and traditional doctor of pharmacy program

2. Content Description
    a. Factors to consider when weaving your virtual education program
        - consistency of course design
        - faculty training
        - creating the "on campus" feel
    b. The Nuts and bolts of creating courseware
        - What administrative web system should I use?
        - How do I create courseware: Faculty generated? Capture live lectures, Technical team to assist development?
        - What do software system do you use for creation and Porting audio/video presentations to the web?
        - Needs assessment of faculty members
        - Training faculty to create digital presentations

    c. How do we assure the quality/outcome of a NTPD , online program is at Least the same as the on campus Pharm.D. program?

    d. Creating a clinical "toolbox" for the NTPD: transferring clinical expertise

Integrating an Online Program into existing University Infrastructure (Barbara Skunza)

Barbara Skunza is the Program Manager for the Non-Traditional PharmD program at Ohio State. She has 20 years of experience in higher education administration and recently earned her Masters Degree in Public Policy and Management (higher education).

Discussions of online programs typically focus on discussions of technology, pedagogy and learners. While important, these discussions do not take into account the underlying political, and administrative, infrastructure necessary to operate an online nontraditional degree program. Servers and bandwidth aside, programs must concern themselves with integrating all of the University services traditional programs take for granted including: marketing, registration, online applications, new committees, codes of conduct, copyright clearance, use agreements with faculty, library resource distribution, etc.

My 10 minutes will focus on how to liaison with existing infrastructure to ensure a smooth administrative transition for your online program. I will follow the process from the initial idea and planning stage all the way through to the first class completing their first term.

Idea Stage: The planning phase for a program like this is necessarily long and involved. It is imperative, at this stage, that the faculty and college community share in the vision and mission of the distance program. It is at this stage that the university support is secured, both financially and philosophically.

Building the team: Most important step. Very important that you have the expertise that you need to make the technology work for the students and the instructors; but more important that they work together well and that they all share the same vision of 'customer/client focus'.

Marketing/recruitment: Ideally there is plenty of time before the first class is expected to be enrolled to engage in a well-thought out marketing scheme. It should be clear from the planning phase what the base of applicants lie. Rather than throw out a large net, we elected to concentrate on our own state, following the mission of our university, to educate and reach out to our own citizens. This strategy has served us well, as we have a large base of alumni in the State of Ohio, who were among the initial voices expressing a desire for OSU to offer a Non-Traditional PharmD.

University Processes: Because we chose to offer this program on a different calendar schedule than the university (trimesters vs. quarters) and because we were the first to offer an academic degree using web-based coursework, we were presented with many challenging administrative tasks. Special arrangements had to be worked out with university officials concerning such issues as admissions, registration, tuition, grades among others. Once in place these processes will be routine and will serve other new distance programs in the university.

Atmosphere: The most important ingredient in the success of our program has been the commitment, excitement and visibility of the team. Because these students have so little personal contact, and little if any opportunity to visit campus, their connection, and sense of belonging, to the university comes from the people with whom they interact…the team.

Regional List Servers as a Means of Peer Support for an On-Line Learning Community

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Abstract: A regional list server is a list server providing peer support to students living in a specific geographic region. This paper analyses the effectiveness of using regional list servers to provide peer support to an on-line learning community of 300 students already using an electronic forum to study by distance. Fifteen list servers were used for the course.

Using list servers for large numbers of students, as in distance education, creates concerns as well as benefits. If even a small number of students post messages to the list, participants may have too many messages to digest. Students in a previous study commented that they preferred to work in smaller groups. Regional list servers provided students with a more intimate experience and reduced message load. The underlying principles behind the study are discussed and an explanation is given of how the interactions on the list servers are stimulated and monitored.

Introduction

The Open Polytechnic of New Zealand is the largest provider of open and distance education in New Zealand. Most teaching is done by distance. The students described in this paper were studying the Computer Concepts paper, a compulsory paper in the National Diploma in Business course and approximately equivalent to first year degree level. Most students are adults in their late 20's to early thirties, approximately two-thirds female and mainly Pakeha (non-Maori). The Maori were the first people to settle in New Zealand. Those not of Maori descent are termed Pakeha. The majority of students on the course had little experience of using a computer for anything more than word processing. Some students used e-mail regularly but most knew how to use e-mail. Few had experience of using Internet forums, list servers or on-line chats.

The creation of a community spirit is an essential prerequisite for success when using an electronic forum (Hiltz 1998) (Anderson 1998). Without this feeling of camaraderie people feel inhibited from posting for fear of looking foolish, or from responding to postings for fear of being branded a "tall poppy" or know-it-all. Speaking up in small class or posting in a small electronic communication space seems much easier because the participants develop relationships and trust with the others in the class. In previous work with an electronic forum (Green & Eves 2001) students commented that smaller workgroups would allow them to get to know other students better. In an effort to provide this more intimate space, several regional list servers based on the regions of New Zealand were created. List servers were chosen in preference to newsgroups for ease of use and the fact that the list server used offered automatic recording of student demographics and archived messages in time sequence. A list server ensured that passive students received the messages even if they didn't participate. Participants were familiar with e-mail and did not need to acquire new skills to use the list server. Students were already using a Delphi forum (Delphi 2001) for asynchronous communication. It was hoped that the relationships and the peer support network that developed would increase the rate of participation in the Delphi forum, our virtual classroom. We were also interested to see how students would respond to the increasingly varied means of student-student communication at their disposal. A major benefit envisaged was that the smaller population would reduce the information overload that can occur in list servers with larger populations.

Method

The postings of students were monitored over a period of 17 weeks. The list server chosen was Listbot (Listbot 2001). Listbot is a free service provided by Microsoft on the Internet. The site allows the creation of list servers for either announcements (one to many) or discussion (many to many). Discussion list servers were chosen to allow those subscribed to send messages to each other. Each list server takes just a few minutes to set up, which includes selecting any information that you wish the list server to gather when students register. Each list server gathered demographic information requested by the list owner when the student subscribed. Thirteen list servers were set up based on the New Zealand regions. Two list servers based on ethnicity/language were set up with the intention of supporting those students whose second language is English in the believe that they could get additional peer support in their first language. These list servers supported Maori and Chinese students.

Students were not spread evenly across New Zealand but were concentrated in the main population centres, two thirds of which are in the North Island. The mountainous South Island, often called the Mainland has less than 1 million people. It was estimated that a group of 5 students would be able to form a viable and cohesive group. During the first two weeks of the course it was essential to support single students and encourage them to subscribe to a neighbouring list server if students numbers were low in their area. This also increased the cross fertilisation of the groups without destroying the intimate sense of the space.

Marketing the list servers

The regional list servers were marketed in our electronic forum (Delphi 2001) and by mail before the start of the course. In addition whenever communicating with students by phone, fax, e-mail, or during weekly on-line chat sessions on the forum, students were reminded of the importance of using their regional list server. The various means of communication were described to the students as follows in order to help them understand what they were to be used for.

"The forum is our electronic classroom; it is necessarily formal and tightly controlled. It is your place to ask questions, to get guidance on how to get started on a particular activity in the course and the place to find and receive answers. It is your frequently asked questions resource. It is not a place to have personal conversations."

"The on-line chat is your student common room, bar or seminar room, it is informal and uncontrolled. It is the place to meet up and talk about the course, what's on TV, to gain motivation and direction, and generally get to know your classmates. Brief personal conversations are acceptable but remember it's one-to-many, so try and follow the threads of the conversations that will be fast and furious!"

"The regional list servers are like inviting people into your home to study with you. It's quick, simple, informal and direct. The e-mail you receive will be from an individual, but everyone on the list will receive the same e-mail. It's the equivalent of a small study group without the hassles of having to travel. People on your list server may be your close or distant neighbours. We encourage you to use it to arrange social events and form face-to-face or virtual study groups."

Monitoring the List Servers

The list owner is automatically subscribed to each list server. This could potentially result in information overload for the tutor even though the tutor role in a peer support network is more for policing than for interaction. In order to control the flow of e-mail, a series of rules were set up in the tutor's e-mail client, Outlook 2000, to direct the mail to a series of folders, each named after the respective list server. To ease tutor communication with the list servers a personal distribution list was also created. This provided the students with a small intimate view of their list server, whereas the tutor had an overview of the activities taking place in every list server. The tutor could address the whole class, a regional group, or an individual. It was considered important that the data for this study was gathered automatically to enable the tutor to concentrate on the tasks of motivating and directing the students in the forum. A

weekly e-mail report from each list server informed the tutor who had subscribed or unsubscribed. E-mail from the groups was archived both on the tutor's computer and in the archives of the individual list servers.

Results

For ease of analysis four regional list servers out of the 15 were analysed. The two largest urban list servers centred on the Auckland and Wellington regions contained 23 and 31 students respectively. The two rural list servers selected were centred on the Bay of Plenty and Waikato regions and contained 7 and 9 students respectively. It should be noted that although well promoted the two list servers set up to allow ethnic students to discuss ideas in their first language were barely used. Both Maori and Chinese students participated fully in the regional list servers but ignored the option of using their first language, even with the opportunity of support by a Chinese-speaking staff member. It is thought that the ethnic servers were viewed as ghettos.

Some questions asked

1. Do students have preferred learning partners with whom they communicate on a regular basis?

Students were asked to identify themselves by posting an introduction to the list server in the first few weeks of the course to encourage interaction. In larger list servers, students had more potential partners than in smaller list servers. However the data in Fig 1 shows that in larger list servers more than 50% of students selected just two partners with whom to talk. In smaller list servers most students made contact with all the other students. Students either posted messages to everyone (shown as 'All' below) or addressed the message to a specific individual. The number of messages posted to their first and subsequent partners were summed and expressed as a percentage of the total number of subscribed students. The percentages shown would have been higher if expressed as a percentage of the active students. People talk with more people in smaller list servers than in larger list servers. Fig 2 shows how the numbers of postings to subsequent partners falls off. This suggests that when group work is done groups of three may be an appropriate size.

List Server	Number of students subscribed	Number of active students	Number of students posting to All (Average number of messages)	% with 1 partner (Average messages)	% with 2 partners	% with 3 partners	% with 4 partners	% with 5 partners
Auckland	23	20	19 (3.47)	60.9 (2.21)	52.2 (2.42)	26.1 (2.00)	26.1 (1.5)	21.7 (1.4)
Wellington	31	22	19 (3.9)	54.8 (2.24)	38.7 (1.17)	25.8 (1.38)	16.1 (2.0)	12.9 (1.0)
Bay of Plenty	7	7	7 (8.29)	85.7 (2.17)	85.7 (2.0)	85.7 (1.5)	28.6 (1.5)	28.6 (1.5)
Waikato	9	7	7 (13.43)	77.8 (4.86)	66.7 (5.67)	66.7 (5.0)	66.7 (5.0)	44.4 (5.0)

Figure 1 – A comparison of the rates of posting and the number of partners in large and small list server populations

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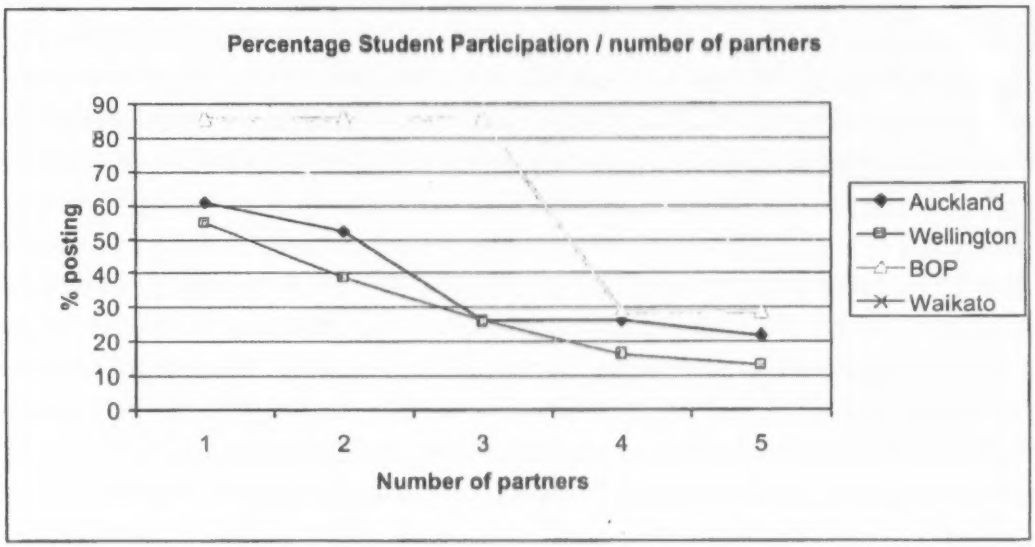

Figure 2 – A graph of the percentage of students posting against the number of partners

2. Do larger populations produce more postings per capita than smaller populations?

It might be expected that the number of interactions would be greater in a larger population due to the greater range of opinions and personalities. This does not appear to be the case (Fig 1). The Bay of Plenty and Waikato list servers received 127 and 287 postings respectively from an active student body of just 7 students each. Auckland and Wellington received only 215 and 202 messages from 20 and 22 active students respectively. Waikato students posted an average of 41 messages each, compared with Auckland's average of just 10.

3. Is there an optimum size for a list server population?

Students joined the list server for their region. This resulted in groups of different sizes because students are not distributed evenly over New Zealand. When the size of list server population is graphed against the average per capita posting for each list server over the period of study, a peak is seen around 9 participants (Fig 3). It is suggested that this figure would rise if a group functioned for a longer period of time and more people came to recognise each other as individuals. Self-disclosure, the divulging of personal information and trust are key elements in raising the level of participation. Those individuals who expressed themselves more fully had more contacts and a greater number of partners than those who merely asked for and exchanged information.

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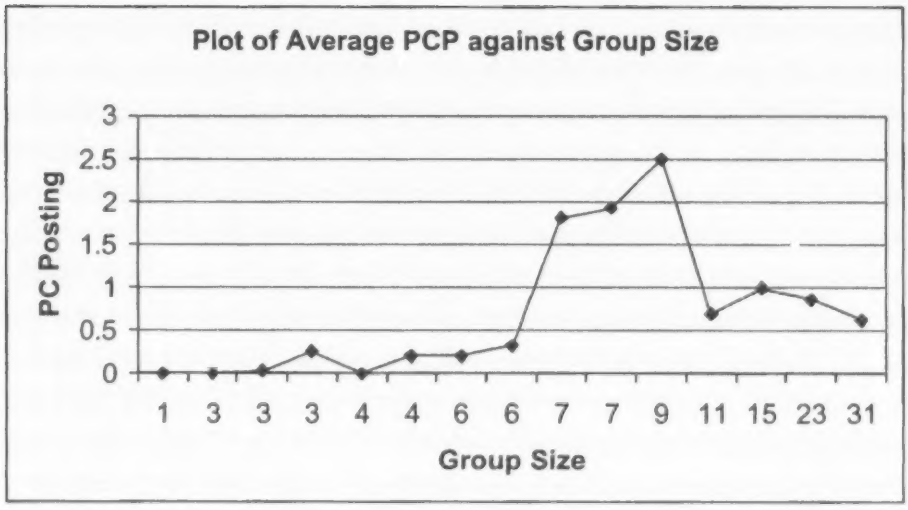

Figure 3 - Graph of the average per capita posting against the list server population size, over the period of study

4. Is there a difference in use of the list servers in urban and rural areas?

In the Wellington central business district, which is compact compared to the sprawling Auckland central business district, the list servers were used to arrange face-to-face study groups that met at weekends and during lunchtimes. This was entirely due to the response of one individual to a tutor suggestion. The posting rates described above (Fig 1) were measured before these groups formed and do not account for the differences in posting. No organised groups formed in Auckland though some students did pair up occasionally. The data shows that the regional list servers were used much more in the rural areas, probably due to the dis tances between students.

5. Is there a relationship between the number of messages a student posts and their success on the course?

Certainly most successful students were students with postings in the high 30's. However several low posters also obtained good results in the assessment and several high posters received lower scores. It is not possible to ignore the fact that everyone received the messages whether they actively participated or not. There appeared to be no relationship between posting rate and success on the course. This seems to echo the results obtained by Poole (Poole 2000) when the number of messages read was related to success on the course. In other words some students can do things other than use the list servers to obtain the necessary feedback, for example using the forum, or be happy to work through the course materials alone.

6. Does increased peer support result in success for all on the list server?

There was no clear difference in the percentage of students on the list servers achieving A+, A or C grades and those who chose not to be on the list servers. This result appears to agree with Poole (Poole 2000) who noted that there was no direct relationship between course grade and the number of messages read in a bulletin board. A larger sample of students might show that those with an intermediate skill level of B+ or B may improve their achievement by intcraction with and observation of higher scoring students.

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7. ***Does increased peer support result in increased retentions?***

There was no apparent difference between the retention rates of the trimester with added peer support by list server and the previous one without this support. Loss of students is almost always due to personal problems with work or home life rather than anything related to the course. Retentions are more likely to be raised by the provision of student counsellors than electronic peer support.

Conclusion

The study found that students posted more messages per capita in list servers with smaller populations. Such small populations tended to be in rural areas. The optimum size of a list server population in terms of the number of postings per student is 9 students. Students in list servers with small populations had more partners with whom they corresponded regularly than list servers with large populations. This may have been influenced by the fact that the smaller list servers were filled with rural dwellers who might be friendlier than city dwellers or simply because those in the cities preferred to use the listbot to arrange face-to-face meetings. Most of the students in the large list servers had only two partners with whom they regularly communicated. This has implications for students working on group projects.

There does not appear to be a relationship between participation in the list server and success on the course. It must also be borne in mind that being in the list server did not indicate whether a student was active in the list server or the level of that activity. Students were also able to interact in the forum. Retention rate was not affected by having peer support and was affected by more personal factors. Posting rate was considered to be an unreliable indicator of future success on the course. It must be borne in mind that everyone received the postings on the listbot regardless of their level of participation. Peer support did not influence the percentage of students achieving grades A+, A or C as there was no real difference between the numbers of students in the different grades in semesters with and without the listbot facility. A further study might demonstrate that intermediate students (B+ or B) could benefit from interaction with higher scoring students.

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DISTRIBUTED LEARNING: INTRANET AND INTERNET APPLICATIONS

Elinor C. Greene, Ph.D., SPHR

ABSTRACT

At a time when learning is finally recognized as a critical component to an organization's success, manufacturing industries are facing an overwhelming challenge to increase efficiency, effectiveness, and competitiveness. Organizations are becoming more centralized, more global, and more competitive, and the traditional classroom model is rapidly losing its value and appeal. Educators and performance improvement practitioners are looking to technology as a tool for effectively growing and maintaining a skilled workforce. Increasingly, companies are using distributed learning technologies to provide timely, economical, and effective learning solutions.

INTRODUCTION

Learning has become the most important part of everyone's job. The continuously changing skill and knowledge requirements of workers create a continuous need for learning. Today's organizations require learning to be delivered faster, cheaper, and more effectively. Organizations are reexamining the entire learning process - when, how, and where learning occurs.

THE COST OF TRAINING

Most training initiatives in the manufacturing world are classroom driven, led by trainers who were not educated as educators. They deliver content that is often irrelevant, to passive and disinterested learners, on an overtime basis requiring 12 hour shifts, with little or no effective measurements [1].

The costs associated with traditional methods of training are impeding our ability to compete. In 1998, the largest U.S. companies spent over $70 billion on employee training [2]. Half of this was on travel costs, wages, and benefits for employees while in training. A substantial portion was spent on inefficient or outmoded approaches to delivering workforce education.

Perhaps the greatest single issue that impacts classroom learning is time. Most training delivered by instructors is delivered at the pace of the slowest learner in the class. At the same time, companies are applying pressure to limit the amount of time employees spend in the classroom. This dilemma, coupled with an increased demand for training, creates a need for new and innovative methods to develop and deliver more effective training.

THE CHALLENGE

Today's technology is reshaping our workplace. As job skills are becoming obsolete, tomorrow's jobs will require a whole new set of worker skills. Not only will the skills of low-skill level employees need to be strengthened, but also employees in jobs requiring high skill levels will require continuous retraining. It is only through company-wide learning systems that organizations can survive. Companies today have little choice but to become learning organizations.

THE LEARNING ORGANIZATION

The learning organization empowers people to learn as they work. It uses technology to collect, store, organize, customize, and transfer vast amounts of knowledge. The learning organization provides training that is just in time - when it's needed, where it's needed, and how it's needed.

The learning organization has four distinct characteristics:

1. It is performance-based; tied to business objectives.
2. It emphasizes skills, and how people process information.
3. It assumes learning is part of work and not separate from work.
4. It incorporates distributed learning applications.

The challenge of learning faster than one's competitors is being met through distributed learning technologies, which include the intranet, internet, computer-based training, and electronic performance support systems (EPSS).

WHAT IS DISTRIBUTED LEARNING?

Distributed learning is a system and process that optimizes learning and productivity. It considers both presentation (how information is presented to learners) and distribution (how information is delivered to learners) using a combination of technology; learning methodologies, on-line collaboration, and instructor facilitation to achieve applied learning results. Results that are not possible from traditional education are achieved in a flexible, anytime/anywhere fashion.

Whether the training is provided by CD-ROM, the internet, or the company's intranet, distributed learning provides the power to speed up learning and make knowledge more accessible and economical. Today's corporations are using distributed learning applications to train and retrain both their centrally located and globally dispersed workforces.

In a survey of 700 training professionals conducted in February by the Masie Center, 80% of respondents said that they expect the demand for Web-based training to increase in their organizations this year. By contrast, 75% said they expect more demand for CD-ROM based training, and more that 60% said they expect the same for classroom-based training [3].

Corporations are using distributed learning applications to address the following needs:

- Job skills training and retraining
- Government compliance training
- Management development and leadership training
- New product and policy information
- Employee orientation
- Product sales training
- Customer education
- Sales force automation training
- Higher education

Synchronous and Asynchronous Learning

Distributed learning applications can be either synchronous or asynchronous, and generally include a combination of both.

Synchronous learning occurs in real time. It creates a virtual classroom environment with no time delay. For example, an instructor located in Atlanta may conduct a class on Programmable Logic Controllers with students in 20 or more different locations and countries. The instructor can share applications with the students, ask and answer questions, and let a student take control of the screen or simulation software. All that is required of the students is a browser and an audio hook-up, accomplished by a telephone line. Responses to learner interactions and tests are uploaded to a central location for scoring.

Researchers have reported that there is no significant difference in the achievement of students in systematically designed virtual learning environments and the achievement of those in systematically designed face-to-face environments, based on standard performance measures [4]. And with shorter

contact times, supplemented with asynchronous technologies, synchronous learning yields superior results.

Synchronous classroom learning has been widely recognized as an effective means of teaching and learning with benefits to the learners and the organization. For example, in 1989 AT&T obtained cost figures for courses delivered via distance learning technologies such as satellite up-link and down-link technologies. The courses were systematically designed using criterion-referenced methods [note 1] (the author was involved in both designing and evaluating the impact of these courses). During that year, 3,650 students attended distance delivered sessions of the courses. Savings in airfare, lodging, and daily expenses resulted in a total cost savings for the 3,650 students of $1,825,000. These figures do not include downtime while traveling.

Asynchronous learning allows participants to learn anytime, anywhere. For instance, students may download and print articles, flowcharts, P&ID drawings, electrical diagrams, or policies and procedures from the company's intranet. Or they may download a computer-based course on Lotus notes from the company intranet. They may take the course later from their seat on a plane. Or a student may elect to take a course on Hazard Communication directly on the internet from home, at a time that is convenient. When the student takes the test or completes an assignment or exercise, the responses are uploaded to a central location for scoring. Examples of asynchronous learning include self-paced, interactive multimedia courses and electronic performance support systems (EPSS).

Self-paced, Interactive Multimedia Training

Self-paced, interactive multimedia training allows participants to learn anytime, anywhere. Students can take a course off a CD-ROM, the internet or intranet, or download and run it from a computer. Multimedia training provides a multi-sensory approach to learning through audio, video, animations, and text. Learning is active rather than passive and students have control of their own learning. Students who require more time or additional practice on a particular topic can spend the time without holding back the rest of the class. Students who grasp new topics easily move through a lesson quickly. Conditional branching, based on performance on pretests and embedded tests, allows students to effectively concentrate on what they don't know without having to relearn what they already know. Multimedia simulations allows learners to experience high-risk situations without endangering themselves, other workers, or expensive equipment.

One would expect self paced, interactive multimedia courses which have been systematically designed using criterion-referenced methods to have the same effects as face-to-face instructor led courses which have also been systematically designed. However, independent studies comparing multimedia to Instructor-led training across five industries have shown significant results in several categories including retention, learning gains, learning curve, consistency, and reductions in learning time (see figure 1).

Figure 1. Comparison of Multimedia to Instructor-Led Training

Learning Variable	Percentage Increase
Retention of Content	20 - 60% Higher
Learning Gains	56% Greater
Learning Curve	60% Faster
Consistency of Learning	50 - 60% Better
Time on Learning	38 - 70% Faster
Sources: US ARMY, WICAT, United Technologies, Federal Express, Xerox	

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Electronic Performance Support Systems

The most effective learning happens when training is part of the work process. Electronic performance support systems (EPSS) provide users with the information, knowledge, and tools to perform nearly any job or task while they are performing their job. A well-designed EPSS will enable a new user to perform his or her job to specified criteria the first day on the job. EPSSs use hypertext, embedded animations, and hypermedia to enable the user to perform new or high-risk tasks, or a job/task performed infrequently, with minimal training or support from others. Short, task oriented courseware modules provide users with on-the-spot training for nearly any job-related task. EPSSs generally do not run as stand alone PC applications.

BENEFITS OF DISTRIBUTED LEARNING

Organizations that have successfully implemented distributed learning have achieved both productivity improvements and cost benefits. These organizations reported the following ten benefits:

1. Increased impact of dollars invested in training. Companies are saving money because they use fewer instructors to reach more students. They are also realizing reduced travel costs, reduced downtime, and the ability to train a dispersed workforce.
2. Consistent message. The centralization of information and databases provides improved constancy of content and delivery. Organizations can easily update and make available current information to all employees.
3. Reusable content. Companies using distributed learning technologies are finding that the content can easily be re-purposed and used across applications.
4. Safe learning environment. Virtual reality and simulation technology allows trainees to view and interact with objects that would be impractical or impossible in reality.
5. Hands on interactivity. Distributed learning technologies allow for hands-on, direct, and immediate interaction with instructors, other learners, and courseware content.
6. Just-in-time information access. Unlike traditional training, distributed learning enables students to find and use the information they need when they need it. This allows for increased flexibility for students and instructors.
7. Learner centered training. With distributed learning applications, students control their own learning. The courseware moves students to new topics, remediation, or additional practice based upon their responses.
8. Real time learning. Distributed learning allows geographically dispersed students to interact with instructors and students in virtual classrooms.
9. Easy access to remote experts. An expert in recovery boiler operations interacts with students in real time, answering their questions and collaborating with the group.
10. Fewer disruptions to work. Students participate in learning at their own convenience, without disrupting critical work activities. They also enjoy convenient scheduling for training.

SUCCESS STORIES

The decision to implement distributed learning is an important step toward becoming a learning organization. The power and flexibility of distributed learning technologies make them suitable for meeting a wide range of education and training needs. The following organizations have benefited from successful deployment of distributed learning applications.

Buckman Laboratories received numerous awards for technology managed learning. Their distributed learning system allows employees to study at convenient times without interrupting their business and personal schedules. In addition to delivering courseware and other content, Buckman's on-line training is instructor led, which helps ensure that students are keeping up with the pace and the assignments. It includes interaction at any level the student desires: privately with the instructor, privately with one or more other students, or publicly with the entire class. The training courses encourage students/employees to collaborate on assignments.

General Motors uses an EPSS application that imparts information through formal courses and captures new knowledge which is discovered while employees work. The automaker is developing its application to run on notebook-sized PCs that the technicians wear on their belts. The technicians control the voice-driven system by speaking into microphones. They view the graphical interface on a flat-panel display mounted nearby.

Weyerhaeuser Southern Lumber and Plywood Division is using asynchronous computer-based multimedia lessons to teach operators to safely load, unload, and move railcars.

Boeing Training Centers provide simulation training for pilots and ground crew technicians via integrated CD-ROM and laser disk technology. Training modules are downloaded into the network at training centers in Seattle and Miami. Each student accesses training through a Windows-based PC.

Eli Lilly & Co. is using the Scientific Performance Improvement Network (Spin) for its Research scientists. This custom application combines threaded discussions, a directory of subject-matter experts, links to databases, and online courses.

Astra Pharmaceuticals is using distributed learning applications for training on government Regulations.

Siemens Business Communication has moved to distributed learning from face to face classroom training. The results have been a 3.7% increase in productivity for 25 full time field engineers or 25 million in savings. Siemens saved $105,000 the first week they implemented the course. As a result of using distributed learning, they saved $800,000 during the first year of full time implementation.

Target Stores uses video simulations of situations a Target employee might encounter when working the complaint desk. The employee being trained sees a video of a complaining customer, responds, and then has his or her choice of words evaluated by the system.

The Department of Defense Dependents School provides distance distributed learning to students located in 14 different countries. Through this initiative students and parents are able to communicate with teachers, participate in learning activities, and work with military and community experts.

McGill University's Mining and Metallurgical Engineering Department is using distributed learning applications to teach engineering courses to students in remote locations. Dr. Ralph Harris has successfully implemented the concept of real and metaphorical bridges for web delivery of course content and performance of exercises and activities that are only feasible in an electronic environment [5].

Georgia Institute of Technology, the University of Wisconsin, and Florida State University are three of the growing number of major universities providing distributed learning applications to remotely located students enrolled in undergraduate, graduate, and continuing education courses.

CONCLUSION

Today's companies are searching for new ways to maintain their competitiveness while reducing cost and increasing the availability of quality training to their employees. More and more companies are becoming true learning organizations by adopting distributed learning applications. Distributed learning uses technology to empower people to learn as they work, and provides training that is just in time - when it's needed, where it's needed, and how it's needed. Some of the benefits organizations have achieved include increased productivity, reduced costs, consistent message, reusable content, and fewer disruptions to work. If companies in the manufacturing industry are to remain competitive in this rapidly changing global economy, they must become learning organizations and adopt distributed learning applications to better serve their employees and their companies.

NOTES

Note 1. Criterion Referenced Instruction (CRI) is instruction which has been systematically developed to solve an identified, measurable performance problem. For each performance objective, a criterion or standard by which performance will be judged is specified. The criterion may be a time limit, an accuracy tolerance, or a proportion of correct responses. The training is built to facilitate attainment of the performance criterion and a hands-on performance test is given to measure mastery or criterion achievement.

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Relational Behaviors and the Development of Cooperative Learning Groups Using Computer Conferencing: A Case Study

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How does a collection of strangers move from being an aggregate of people to a group capable of high performance using computer-mediated communication (CMC), specifically computer conferencing, as the sole means of communication? This study will elucidate the important aspects to consider when using cooperative group instructional strategies for distance learning mediated by text-based Internet communication. Understanding the cooperative group processes when using CMC that provide for the development of successful interpersonal communication leading to close interpersonal relationships will: (1) provide information for instructional designers and instructors of online courses to guide their design and delivery efforts in terms of group composition, group activities, and facilitation strategies, and (2) guide design of better interfaces and software to enhance effective communication interaction. Attending to the demands for socially functional groups is even more crucial as the aggregate of individuals coalesces into a group and, with time, evolves into a learning community.

UNIVERSIDAD AUTONOMA METROPOLITANA

The importance of Graphic Design in the develope of an educational web site.
Experiences in the building of the site for the Postgraduated Design Program for Develope of Interactive products.

Abstract
This paper describes the experiences of a research team in Mexico City in the Public Higher Institution Universidad Autonoma Metropolitana. I'm presenting the results of a year of working in the construction of the entire site for a Postgraduated Program in Develope of Interactive products, oriented mainly to those who are involved in the areas of design, visual arts, multimedia, etc. We are trying not only to build a web site according to graphic parameters and instructional design, farther we are looking for an application program that also will be built around a strong central narrative, but typically offer more opportunities for students to pursue interesting digression from the main themes of the web site. We are planing to present information more sophisticated and in-depth than in trainig tipycally applications. We are structuring and developing not only an online course or a Postgraduated program specifically for designers, we are also trying to build a Web-based learning environment providing student with feedback, incentives and interactivity, according for what they are looking for.

I am going to describes my experiences, as a graphic designer, beeing a part of a research team in Mexico City in the Public University Universidad Autonoma Metropolitana. We now are working in the construction of the entire site for a Postgraduated Program in Develope of Interactive products, oriented mainly to those who are involved in the areas of design, visual arts, multimedia, etc. We are trying not only to build a web site according to graphic parameters and instructional design, farther we are looking for an application program that also will be built around a strong central narrative, but typically offer more opportunities for students to pursue interesting digression from the main themes of the web site. We are planing to present information more sophisticated and in-depth than in trainig tipycally applications.

We began our work by the identification of our target audience, describing main objectives and then identifying all of the content information and graphic resources we will need to collect or create to achive the goals for the Web site of the specialization in Develope of Interactive products.

Im going to present our design strategies:
The first step in designing a Web site is to make sure you have clear statement of purpose and objectives to project. Careful planning and a clear sense of purpose are the keys to sucess in building Web sites, particularly if you will be working as a part of a team to builder the site.

First of all we consider our potential users, students interested in a design specialization inside the new technologies, because we know tha it´s impossible to design for an unknown person whose needs you don´t uderstand. So that what we have to do is testing the designs and getting feedback from users, this is the best way to see whether the design ideas are giving users what they want from the site.

The design must allow fast access to a wide range of topics, with links to related material within the local web site and beyond on the World Wide Web. We think that graphic user interfaces were designed to give people direct control over their personal computers. Users now expect a level of design sophistication from all graphic interfaces, including web pages. The goal, we are sure, is to provide for the needs of all of the potential users, adapting Web technology to their expectations, and never requirig the rader to simply conform to an interface that puts unnecessary obtacles in their paths.

Web sites can vary enormously in their style, content, organization, and purpose, but all Web sites that are primarily designed to act as an information resources share some basic characteristics. The spatial organization of graphic and text on a Web page can engage the user with graphic impact, direct the users attention, prioritize information, and make the user´s interaction with the web site more enjoyable and efficient.

Design and visual logic
Graphic design creates visual logic, an optimal balance between visual sensation and graphic or text information. Without the visual impact of shape, color, and contrast pages are often graphically boring and will not motivate the viewer to investigate their contents.. Dense text documents without the contrast and visual relief offered by graphics and careful page layout and typography are also more difficult to read, particularly on the relatively low resolution screens of current personal computers.

Visual and functional continuity in your Web site organization, graphic design, and typography are essential to convince the audience that your Web site offers then timely, accurate and useful information. A careful, systematic approach to page

design can simplify navigation, reduce errors and make it much easier for users to take full advantage of the information and features of the Web site.

We are structuring and developing not only an online course or a Postgraduated program specifically for designers, we are also trying to build a Web-based learning environment providing student with feedback, incentives and interactivity, according for what they are looking for.

Our main objectives are centered into students, but we also have a problem we are trying to teach design, with a designed interface to designers, this became great challenge. So that we are conceiving a new metaphor for the spread of innovation in teaching and learning. We use technology to help students learn.

According to those considerations we think that a site with poor visual design and low editorial standars will not inspire confidence in the users. If you want to convice your users that what you offer is accurate and reliable you will have to design your web site as carefully as you would any other type of corporate communication, with the same high editorial and design standars. This is related to the recent concept of design Estability that means: design your web site keeping the interactive elements of your site working reliably.

What you have to take on consider?
As a conclusion, I am going to resume in only 10 points the most impotant graphic standars I think you have to take on consider when you decided to build a web site in order to take advantage of the information you put on it and to promote learning:

1.- User-centered desing: create sample scenarios , design for kwon person whose needs you understand and t est your designs.
2.- Build clear navigation aids: build basic links that should be present on every page of your site, clear consistent icons and graphic identity schemes, in order to give a sense to the infomation.
3.- Give users direct accesss: provide the users with the information in the fewest possible steps, and in the shortest time.
4.- Be consistence and use simple metaphors: your interface metaphors should be simple, familiar and logic, so establish a layout grid and a style for text and graphics.
5.- Structure a basic layout: organize the information around a home page that act as an entry of the next web pages, and put in it an structure based on menus, submenus and other home pages.
6.- Design with visual logic: considering the impact of color, shape, contrast and typography you will make it much easier for users to take full advantage of the information.
7.- Understand the medium: the experience for users of Web pages is oriented into two senses: as a direct medium where pages are read online, and as a delivery medium to access information that is downloaded into text files or printed, so that your expectations about how them will use your site must be your design decisions.
8.- Try, with all graphic elements, to stablish a visual hierarchy: if you decided to take on cosider the importance of graphic design in web pages, the first step to use correct elements into your Web site is to create a strong, consistent visual hierarchy, where impotant elements are emphasized, and content is organize logically and predictably.
9.- Define a general "style": not only be careful about graphic elements you have set, consider too the editorial desing and the structure of information, handling appropiate the content on the page.
10.- Use efficiently the Worl Wide Web: graphic designs require far more communications bandwith so that try to be "in" taking full advantage of technology and improve the graphic and design elements with the use of the correct application.

Managing Distributed Personal Firewalls with Smart Data Servers

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Abstract: Modern security architectures tend to become more and more complex. Not only the chances to improve Web applications using several data channels and diverse (TCP-)ports are very promising, but also the risks for criminal attacks and an intrusion into the corporate network are increasing.
The classical solution to protect networks against criminal attacks with firewalls is problematic, though. On the one hand, atacks from the inside are hardly prevented by firewalls, on the other, mobile computing poses additional security risks to the corporate networks. Personal firewalls solve some of those problems, but their central administration is very difficult. In this paper, we will discuss a possible strategy to manage distributed personal firewalls with a central tool, the Smart Data Server.

Introduction

Today's security architectures tend to become more and more complex. There are two main reasons for this. One the one hand, modern programs and applications require an increasing amount of data exchange between networks and the information flow often goes via Internet. On the other hand, potential attackers use sophisticated tools and possess extended knowledge to compromise computer systems via online connections.

The manifold possibilities to fight against these attacks, mostly with one or more levels of firewall complexes, result in very complicated security architectures at least for greater companies. In general, firewalls operate as packet filters or application level gateways. They analyze the network traffic and allow or disallow the transfer of data on base of certain rules.

Unfortunately, most attacks against an internal network do not come from the outside, but from the inside. For this kind of attacks, firewalls are mostly useless. Additionally, mobile computing, where personal laptops are plugged into both, the corporate network and (at home) into the network of a public Internet Service Provider (ISP), poses a serious risk to the integrity of the former one: viruses, worms and all other kinds of beastware may arrive at the inner network of a company (Cohen, 1984) and (Karger, 1987).

One possible answer to the question of how to secure a corporate network in such a situation is the personal firewall. If the protection of a computer does not depend on other machines, servers or programs within the network, the mobility of the system represents no security problem any longer. Likewise, internal network attacks are secured at the last possible station: at the workstation of the employees.

Unhappily, securing a network only by personal firewalls is hardly manageable. Ensuring that all personal firewalls of a company are configured according to the security policy is very difficult. In this contribution, we will focus on solving the problem of managing what we call "Distributed Personal Firewalls" (DPF) on base of a central managing tool: the Smart Data Server (SDS).

Personal Firewalls

Before we discuss special aspects of personal firewall implementations, we will have a closer look at classical firewalls first.

Cheswick and Bellovin define the expression "firewall" in their famous book "Firewalls and Internet Security" (Cheswick & Bellovin, 1995) as "a collection of components placed between two networks that collectively have the following properties:

- All traffic from inside to outside, and vice-versa, must pass through the firewall.
- Only authorized traffic, as defined by the local security policy, will be allowed to pass.
- The firewall itself is immune to penetration."

Many of the existing firewalls are mainly packet filters. They analyze the source and target IP-address of each data packet, check its TCP port number and reject the packet if one of them is not allowed to pass. Other kinds of firewalls are the circuit-level and the application-level gateway. The former is a more elaborated and complex type of packet analyzer that works like a proxy server. Details can be found in (Cheswick & Bellovin, 1995). The latter describes a scheme for "special-purpose" gateways that allows only some applications to pass through.

Personal firewalls are programs that run on front end and client machines rather than on corporate network servers. A general description of personal firewalls and a discussion of some classical examples can be found in (Zych, 2000). In principle, personal firewalls have to manage the same security tasks as classical firewalls. Nevertheless, there are some very important advantages:

- Personal firewalls work even though the communication might be encrypted due to their location on one end of the information flow.
- They are mobile inasmuch as the machine they are running on (for instance a laptop) is mobile, too. Mobile computing requires special personal solutions due to foreign ISP's and several other non-controllable factors.
- They can take care more precisely and specifically of individual security requirements.
- The security level can be easily adjusted (mo stly by the user himself/herself).
- Personal firewalls can help to solve the problem of several entry points into networks whereas centralized firewall systems can hardly manage more than very few entry points.
- The penetration of one personal firewall does not directly imply possible damage for the complete network (due to several other personal firewalls on the other workstations).
- Higher degrees of bandwidth, increasing line speeds and more complex protocols make it very difficult to secure a corporate network by a centralized firewall system.

The main disadvantages of personal firewall solutions, especially for enterprise use, are the following ones:

- In general, the user is responsible to maintain the personal firewall (even though system administrators may help in some cases and with the initial setup).
- Personal firewalls pose security risks for the corporate network due to possible false-configuration (e.g. lack of knowledge or intentional act) and a central maintenance of these systems is very complicated.
- Usually, there is no 7/24 support and supervision of personal firewalls.
- Extensive intrusion detection is very complicated because there is no central administration point.
- Administration rights of personal firewalls sometimes belong to the user of the workstation and not the company's system administrator (especially for older Windows based systems).

Nevertheless, personal firewalls or at least decentralized systems are the upcoming standard to secure complex corporate networks.

In the following, we present a possibility to overcome some of the disadvantages of personal firewalls by proposing a distributed personal firewall architecture that could be managed from a central point by the middleware of the Smart Data Server (SDS).

The Smart Data Server

The Smart Data Server (SDS) as a general framework for distributed functionality is a promising platform

to provide also advanced security needs (Roth et. al., 1999a). The SDS is able to connect different data sources and to improve information exchange. The system serves as middle tier in a three-tier architecture (Roth et. al. 1999b). It can work together with several C/S-components and -structures and is a pure Java implementation. The overall idea is to put intelligence on the server side to increase the efficiency of the communication with the clients. The information channels are scalable towards the security requirements. Especially, strongly encrypted communication between server and client is possible.

Similar approaches can be found in Satoshi Hirona's HORB, an object-oriented request-broker (HORB). The Swift Company works on a product using RMI of Java (Swift). The idea of the "Common Request Broker Architecture" (CORBA) is also related to the SDS in our context (Object Management Group). In this approach, several resources can be distributed over the network. DCOM (Brown, 1997) and Java's RMI (Sun Microsystems, 1998) are also similar to the basic ideas of the SDS.

As already stated, the SDS Java server provides several information channels with scalable security levels. The internal structure of the SDS is with three layers very strict. The layers are illustrated by figure 1.

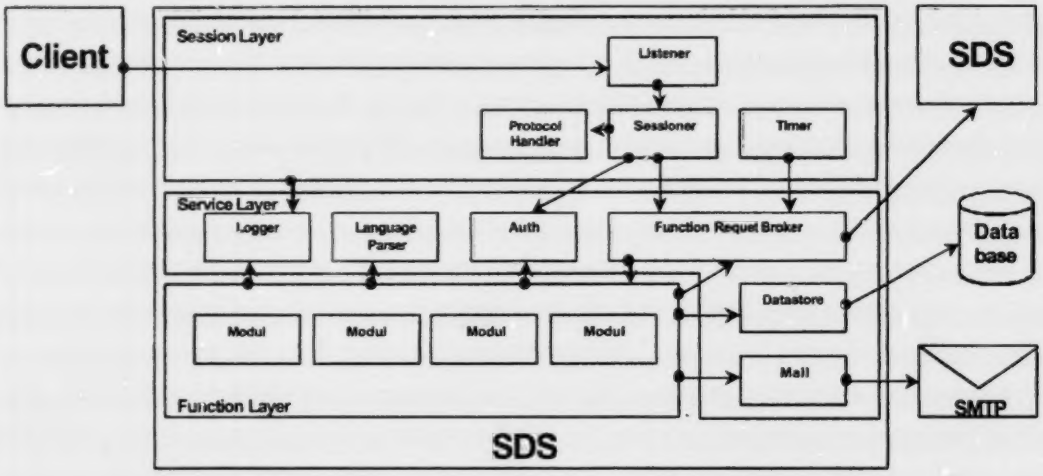

Figure 1: The internal layer structure of the SDS

The session layer is responsible for handling client requests, checking authorization or creating time-based functions by itself. It contains the basic functionality for network-connections, session handling, protocol analyzing and other request-related functionality.

The service layer consists of a set of general usable services that is engaged by both, the function layer and the session layer modules, e.g. a data store module and the central function request broker.

Function layer modules realize the application functionality. In the context of this contribution, the security policy has to be expressed as function layer module so that the rules for the personal firewalls can be distributed to the workstations of each single user.

One special feature of the SDS can help to manage the difficulties arising from distributed security: the SDS can simply be cloned and several instances of the server communicate pretty well with each other. Additionally, functions can be distributed between those clones while they still work on the same databases. Therefore, a clone of the SDS can be placed within the demilitarized zone (DMZ) while others are placed within the inner network to arrange security and trust management tasks. Certainly, it is necessary to design the security architecture for those requirements very carefully. We will have a closer look at this point in the subsequent sections.

Managing Distributed Personal Firewalls

As we have seen already, a firewall nowadays becomes a possible congestion point due to complex protocols and increasing network throughput (Ioannidis et. al., 2000). Distributed personal firewalls that are

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managed from a central server can help to map corporate security policies to the configuration of workstation firewall systems.

In the following, we will provide a possible methodology to overcome the problem of distributing security policy information to decentralized distributed personal firewalls by the use of the Smart Data Server architecture. Especially, firewall rule sets have to be transferred via secured and thus encrypted channels to the client machines. Therefore, every client machine must serve as a client for the SDS communication.

Figure 2 and figure 3 demonstrate the structural and logical task of the managed personal firewalls. While the former one shows a typical firewall architecture (FW) to protect a complex network against attacks from the outside with routers (R), virus scanners (VS), and mail analyzing tools (MA), the latter one illustrates the use of an SDS as central management server to configure distributed personal firewalls.

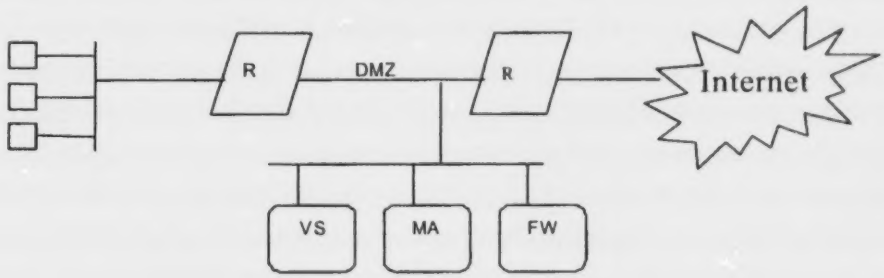

Figure 2: The classical Firewall architecture without use of distributed personal firewalls

The management target is to administer not only personal firewalls on every relevant workstation but also the main (classical) firewalls that run on hosts and analyze the main traffic stream from inside out and vice versa.

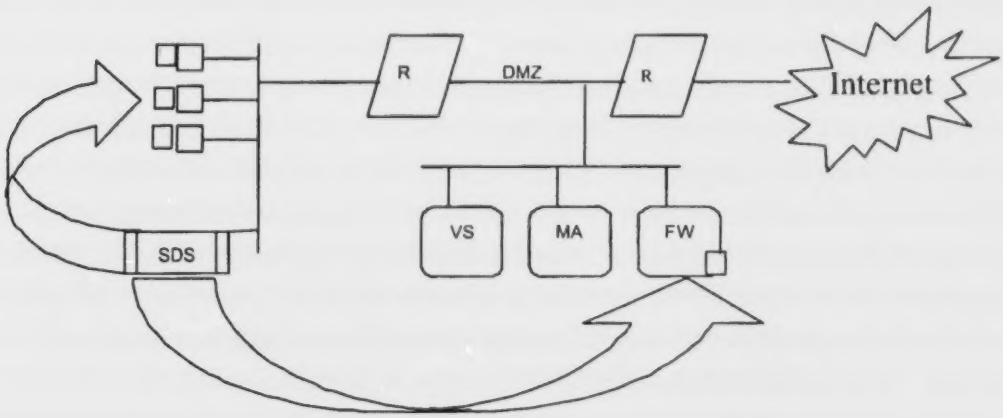

Figure 3: Distributed personal firewall architecture managed by an SDS

As we have seen before, a critical point in the described methodology is the vulnerability of the SDS itself. A worst-case scenario would be an attacker (from the inside) compromising the central managing server itself and thus possibly jeopardize the integrity of the whole corporate network.

Therefore, it is advisable to – at least – "harden" the operating system platform the server is running on. Several companies offer such trusted operating systems on base of Windows-NT or UNIX systems (e.g. Argus Systems Group, Computer Associates International, Hewlett-Packard Company).

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The process of distributing the security policy can then be based on concepts like the *PolicyMaker* as a general approach for trust management. It provides a formal model of trust management and a framework for the development of decentralized security features. A corporate security policy can thus be distributed from the central firewall complex to the single end points of personal firewalls. Further details of the PolicyMaker approach can be found in (Blaze et. al. 1999).

Summary and Outlook

Modern security architectures mostly operate with a central firewall solution. All traffic from the internal corporate network to the Internet and vice versa has to pass through the firewalls. Not only an increasing bandwidth cause problems to that solution, but also encrypted data transfer protocols and manifold security holes arising from mobile computing pushes other methodologies. Additionally, central security tools may cause bottlenecks and potential vulnerabilities for the whole network communication. Even though personal firewalls solve some of these difficulties, they lead to a set of additional problems, mainly administrative ones.

In this contribution, we wanted to point out the idea of distributed personal firewalls, where a central management is able to control the diverse firewalls on the end-user client machines. One possibility would be the Smart Data Server as administrating middleware that has been briefly presented. With scalable secure information channels it can serve as a central management tool for corporate and end-user personal firewalls. Then, a system like the PolicyMaker can help to administer the security tasks for the distributed firewall systems. It is important to see that the central management of distributed personal firewalls also offers new working surfaces for attackers and therefore has to be designed very carefully.

The next steps to go are the verification of the theoretical construction in practice and the evaluation of the security aspects. After this, also questions of performance and the overall efficiency of the approach have to be examined.

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Collaborative Development and Evaluation of Web-based Resources: Problems Encountered and Lessons Learnt

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Abstract: During collaborative development and evaluation of a set of web-accessible shared resources for teaching introductory programming in Java by staff from several campuses and courses, a number of issues arose that reduced the effectiveness of these processes. This paper highlights the issues that occurred during development and evaluation, describes the lessons learnt, and considers ways of solving these problems for development of future resources.

The Project

The aim of this project was to develop a set of shared modular resources, accessible via the World Wide Web, intended to support the teaching of first year programming in Java in several different degree programs. It was intended that the lecturers could use these resources as they saw fit, e.g., as demonstrations during a lecture, or as exercises for students to work through during tutorials, or as additional resources for students to use at home. The resources therefore were not tied to any particular course's sequence of topics, but were intended to be stand-alone.
The project group initially consisted of ten academic staff members from four campuses and three Schools within the faculty, teaching in four different degree programs.
At the commencement of the project, the project leader introduced a strategy for the design and development of the resources, together with a vision of a collaborative process for the project group. This strategy had earlier been employed for developing other resources (Ellis *et al.* 1998). The first couple of meetings were spent establishing a list of resources to be developed. These sessions included brainstorming to determine topic areas, associated and prerequisite information, and levels of difficulty within each topic (Ellis *et al.* 1999). For the development stage, the group was divided into three sub-groups, each to design and develop one resource. By the end of the first year, only part of two of the three resources had been developed. Only four group members remained. The main reason for the dwindling of the project group was lack of time for the project. All staff on the project team had high teaching and administrative loads, and none of the grant funding was for load relief for staff to work on the project. After the initial stage, project meetings became reporting and planning occasions rather than working meetings. This was partly because, since group members were on different campuses, many meetings were conducted via videoconferences. This slowed down the process of evaluation, especially development of instruments.

The Evaluation Process

The evaluation specified in the original grant application included: a survey at the beginning of semester to determine the students' knowledge and understanding of learning processes, self-directed learning, group work, and information technology including programming; measurement of students' use of, and responses to, the resources through online monitoring and questionnaires; semi-structured interviews with a focus group of students about their response to the resources; semi-structured interviews with teaching staff about their response to the resources and

their ways of using them within different teaching styles (e.g., lectures plus tutorials, problem-based learning, and distance education); and a final survey to ask students to evaluate the resources.

The ASCILITE CUTSD Project

At the end of the first year, the group applied successfully to become part of a project funded by a CUTSD (Council of University Teaching Staff Development) grant (see CUTSD 2000) obtained by ASCILITE (Australasian Society for Computers In Learning In Tertiary Education). An ASCILITE mentor was assigned to assist with the evaluation of our resources. The mentor introduced a web-based Collaborative Workspace for communication between the group members. Documents were placed into this workspace and could be accessed and amended by anyone in the group. However, many group members were too busy to experiment with using it effectively, and tended to revert to email to distribute versions of documents.

ASCILITE proposed the concept of Action Inquiry, defined in the CUTSD evaluation handbook as "the deliberate use of a plan, act, describe and review cycle for inquiry into action in a field of practice" (Phillips *et al.* 2000). This is particularly useful in educational evaluation as it offers a methodology that supports research by practitioners in the field with a particular commitment to collaborative curriculum development and evaluation work. The CUTSD project intended mentors to use an Action Inquiry cycle to support the mentees with their evaluation project. As the project was not initially grounded in Action Inquiry, the project team had to adapt it to the Action Inquiry methodology. Wadsworth (Wadsworth 1997) suggests that the investigator must spend equal time on each activity in the cycle. From an Action Inquiry perspective, the team was unable to maintain the spiral of activities that lead a systematic inquiry into practice.

Conclusion: Summary of Lessons Learnt

- The involvement in the ASCILITE project forced the completion and evaluation of several Java resources.
- The budget should have included funding for release of staff from other duties, for the development process.
- The budget should also have included an allocation of funding for evaluation, in order to establish a detailed plan and develop instruments earlier.
- It would have been useful if staff members who were involved in the project had continued to teach related courses. This would have assisted them to retain a higher level of motivation.
- Productive working meetings should have been scheduled regularly, with planning meetings less frequently.
- The development of prototypes by student groups would have provided developers with a more detailed idea of what was required, resulting in much faster completion of the resources.
- The Action Inquiry cycle is designed to evaluate a course in order to improve teaching practice, rather than to evaluate resources used to support it. The resources used in a programming course have a short life expectancy as the technology is changing rapidly. Any delays in the development of resources may result in those resources being of limited or no use. What was needed was a different evaluation methodology that enabled rapid evaluation of the resources.

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Educational JavaBeans: a Requirements Driven Architecture

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Abstract In this paper we investigate, through a case study, the development of a software architecture that is compatible with a system's high-level requirements. The case study is an example of an extended customer/supplier relationship (post-point of sale support) involved in e-Universities, this being representative of a class of enterprise without current architectural support.
In detail, we describe the relevant high-level business processes. We highlight requirements and challenges of the current business model and explore discharging and meeting them through electronic support. We propose a new blueprint architecture and argue that it is compatible with these requirements and challenges. Finally, we discuss the wider applicability of the new blueprint architecture in a wider enterprise setting.

1. Introduction

With increasing demands being made for the electronic support of distance learning and teaching, there are many reasons why an architecture for *electronic Learning and Teaching* (eLT) is important and timely:

- initiatives such as the EU Ariadne project (http://ariadne.unil.ch/) or the UK e-University (http://www.hefce.ac.uk/Pubs/default.asp) introduce new challenges for the Educational Engineer to include infrastructural electronic support for the business of learning and teaching at a distance;
- platform independent technologies are available which already go some of the way towards supporting the business model.

In fact, educational software development has never been so central to the success of a university. The UK education market is not without good electronic support; the Open University being only one of many institutions making use of information technologies in their teaching. Current development practice can, however, only be described as *ad hoc*. One of the reasons for this, we feel, is the lack of a proper foundation for the building of educational software systems. We have not yet reached a 'technological critical mass' for educational software development.
On the other hand, such a critical mass has been reached for eCommerce systems, witness the recent explosion of electronic commerce products. Technologies such as the Java 2 Enterprise Edition (J2EE) platform (Shannon et al. 2000), which includes the Enterprise JavaBeans™ (EJB) architecture, have provided the catalyst for eCommerce systems development. In this paper, we hope to go someway towards identifying the catalyst for education software development. We wish to build on the firm bases provided by EJB to extend its properties and philosophy to cover distance learning and teaching.

1.1 eLT Products, Services and Business Processes

There are strong similarities between many of the business processes of commerce operations and those within distance learning and teaching. In the most general case, both have customers; both work on a contract basis; both provide end-user support; both work through intermediaries. Moving into the electronic setting of eCommerce and eLT, we may deduce that EJB goes someway towards servicing the electronic support needs of eLT. However, with few exceptions, eCommerce has concentrated on the exchange of physical goods for which post-point of sale electronic support is unnecessary - delivery and use happen in the material rather than the

electronic world. In eLT, the commodity on offer is information employed by the end-user (potentially) every day; in this case, continued close involvement in the product is integral with its delivery and use.
Supporting (and extending) the richness of the customer/supplier dialog whilst building on previous best practice provides our motivational focus for the development of the blueprint architecture proposed in this paper, the Educational JavaBeans (EdJB) architecture. In the next section we focus on eliciting requirements for the support of the distance learning educational dialog. We begin by considering its current manifestation within the Open University, the major provider of distance education in the UK. As this is not a paper on the distance learning model *per se*, for brevity we stop short of describing the minutiae of the model, concentrating on the relevant higher-level aspects of the model.

2. Supporting Current Practice in Distance Learning

The Open University (OU) teaches, at a distance, to over 150,000 students per year. The OU teaching model - also called *supported open distance learning* - has evolved over thirty years to its current efficient and effective form. Because their use is best understood, it bases teaching on text technologies, i.e., books, electronic documents, web pages, continuous assessment and exam papers, but there is some *ad hoc* use of supporting media - such as television, audio cassettes and computer-based instruction.
The business processes underlying the OU teaching model are well defined, effective, efficient and scaleable, and so provide a rich source of dialogs between stakeholders for requirements elicitation. For the purpose of our discussion, we identify the following stakeholder groups within the OU model: *students*, *associate lecturers* (ALs, also called *tutors*), *course authoring teams*, and *student recruitment teams*.
In this section we consider, from a high-level perspective, dialogs between those stakeholders. Each dialog description is structured as follows: we describe the dialog as it exists and from this description determine minimum requirements for the EdJB architecture to be able to provide support. We then identify the 'challenges' that exist within the current model that we feel can be met by 'extended' electronic support.
Reality check: So that this paper is grounded in reality, we must consider the quality of electronic support that is currently available and sustainably available in the future. We will therefore not assume that electronic support is required as a 24/7 thing (i.e., 24 hours per day, 7 days per week), only that there will be relatively short, non-contiguous periods with the end-user in electronic contact with the supplier. Moreover, neither will we assume that the supplier can determine nor influence *a priori* the time that the end-user spends on-line. The justification for this mode of operation comes down to the fact that it is the customer who determines product use - even when that product is electronically supported. This is clearly unlikely to change.
The following section describes the dialogs that motivate the architecture. A dialog description is followed by derived requirements (labeled **R**<requirement number>, for reference). Then, in a box, we identify challenges, i.e., things that cannot yet be done, but with electronic support may be possible. Such challenges again source requirements, labeled as above.

2.1. Student/Student Recruitment Team Interaction: Receiving Materials

Currently, the primary delivery mode for learning materials is by paper mail at the start of the course. When necessary, a second major mailing will provide further material later on during the course. Minor mailings will then be used to inform students of errata in the course materials, should errata be brought to the course authoring teams attention during a course presentation.
Derived requirements – The architecture must:

R1 provide support for the publication and delivery of teaching materials

Challenge
It is important to note that, due to the present reliance on paper-like media, having the characteristic of being unchangeable when 'published', course texts remain unchanged, often for many years, even when problems with the material are known[1]. Even though every effort is made to inform students of errata, a student will often be

[1] Another way of seeing these characteristics is that the OU is tied to the use of media that require long 'print' runs for them to be economic. Even certain electronic media, such as CDROMs, share such characteristics.

unaware of the presence of errata, or become aware of them a long time after the error was encountered. This can have a serious and deleterious effect on the learning and teaching experience, which can contribute greatly to student (and so customer) dissatisfaction. Providing a changeable (i.e., electronic, server-side) media base can address this challenge, as long as suitable materials management, such as versioning and configuration management technologies, are also available.
Derived requirements – The architecture should:

R2 provide support for the use of changeable teaching materials as the basis of the teaching provision

2.2. Student/Tutor Interaction: Studying

Study is deadline-driven by continuous assessment components (CACs). Tutor marking of CACs provides validation and feedback on a student's learning experience. For a half credit course (one academic year's part-time study) there will be between 6 and 8 CACs; tutor marking of assessment material - closing the feedback loop between student and university - can therefore typically occur as infrequently as 5 to 7 weeks.
In addition, synchronous interactions are widely acknowledged by students and teachers alike as being very valuable. Until recently, the only means of achieving them was by telephone - with the obvious restriction on number of participants - or by personal contact - which requires travel to and, for some, an unwelcome commitment of time at some study centre. Currently, some electronic support is available, using conferencing tools such as Lyceum (Rapanotti & Hall 2000), and their use should be facilitated by the architecture.
Derived requirements –The architecture must provide support for:

R3 periodic external study validation

R4 for synchronous interactions at a distance

Challenge
Between CACs, *self*-assessment materials (SAMs) provide students with feedback on much shorter time scales– typically on a *per* subsection study basis (i.e., from minutes to hours) - answers being provided along with the teaching text. Although often enriching, such non-external validation mechanisms can also impact negatively the student experience: although success can breed success, failure on SAMs can lead to student demoralisation. Reasons for failure are twofold: the student has not understood the materials on which they are assessing themselves; there are errors in the SAMs (which unfortunately can happen). Given that external validation can be 5 to 7 weeks away, this can lead to students becoming seriously misguided before any corrective action can be taken. Currently, there is no university-wide mechanism for tutor-validation (or otherwise) of activities between CACs. What is needed is a dialog between student and tutor that has a much finer granularity than the current 5-7 weeks but which overloads neither the student nor the tutor.
Derived requirements – The architecture should:

R5 provide support for periodic external study validation at a fine granularity (i.e., *per* SAM)

2.3. Tutor/Student Interaction: Supporting a Student's Learning

Tutors are the embodiment of the university during course presentation: they provide support for learning and pastoral care to students. Tutors mark their students' scripts. They are assisted in this task by 'tutor notes' issued by course authoring teams and including solutions and a marking scheme. Tutors receive the scripts from their students at particular deadlines set by the course study calendar, and return the marked scripts to the OU headquarters for processing – registering marks and having their marking monitored – from where they are returned to the students. Script submission, marking and processing are largely text-based.
Derived requirements – The architecture must provide support for:

R6 tutor/student dialogs

R7 receiving, marking, processing and returning scripts

R8 monitoring tutor performance

R9 delivering and updating of tutor notes

Challenge
Tutors are a valuable resource for the university, not only in their role as course presenters, but in that they are customer facing. By being in contact with students possibly on a day to day basis, tutors are able to collect students' comments on course materials throughout the study period. Mechanisms exist for relaying this

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information back to the course authoring teams for materials improvement, but too often are such valuable perspectives lost. The availability of a fine grain interaction mechanism could facilitate their collection and use to update course materials on an on-going basis.
Derived requirements – The architecture should:
R10 provide support for fine grain interactions between tutor and course authoring team

3. An Architecture for eLT

In this section we describe in broad terms the EdJB blueprint architecture. EdJB is a proposed extension to Enterprise JavaBeans. Its goals are:

- to leverage the technology of Enterprise JavaBeans to help the Educational Engineer;
- to provide a uniform and scalable software platform upon which the development of distance learning and teaching system development can take place;
- to provide support for the business processes of distance learning and teaching.

By being based on EJB, EdJB fosters the reuse of electronic support for programmes and courses based on the development and/or acquisition of components that can be customized, assembled and deployed in a variety of settings. At the same time:

- as does EJB, it provides a standard component architecture for building distance learning and teaching electronic support, and makes the development of eLT support applications easier allowing a concentration on the business logic of learning and teaching, rather than the low-level mechanisms for security and trust, for instance;
- it inherits from EJB desirable characteristics of electronic support, such as platform independence, that make eLT available to the whole community;
- it relies upon tried and tested technologies and includes support for legacy systems so that there is no 'ground zero' for development.

The reader should note that we do not claim in this paper to develop any radical technologies; from our perspective such radicalism is not required. Besides, as EJB gains credence as the standard platform for the development and deployment of eCommerce applications, EdJB-based systems will combine seamlessly with commercial applications. Before entering into the details of the EdJB architecture, we first identify those features of the EJB architecture upon which we will build.

3.1. The EJB Architecture

The EJB architecture, described in (Shannon et al. 2000), is an application of the 3-tier architecture. As such it separates *client view* from *business logic* from *persistent storage*; moreover, interactions between the tiers are heavily (but usefully) constrained. The EJB architecture is outlined in (Fig. 1a).
One of the strengths of the EJB architecture is that it supplies *data persistence*, *security*, and *transaction management* - low-level technologies underlying many of today's eCommerce interactions. In doing this, eCommerce application development is greatly facilitated: the eCommerce developer can focus his or her efforts on capturing relevant business logic, delegating to the EJB architecture the provision of the low-level technologies. As illustrated in (Fig. 1a), EJB containers package business logic together with services. Services offered by the EJB containers are invoked through APIs (Application Programming Interfaces) defined within the architecture. Note that EJB containers and Enterprise beans, by residing in the architecture's middle-tier, are intended to be used (and usually are) for the definition of server side logic. This is perfectly adequate for current eCommerce application where most of the computation is performed by the server, with (so-called) thin clients presenting, what are usually web based, user interfaces.

3.2 The EdJB Architecture: from Requirements to Architecture

We have already noted that eCommerce and eLT share many requirements. It follows that eLT will also require data persistence, security and transaction management as basic services. We argue, however, that eLT interactions also require a new type of service that we call, for want of a better term, *cache coherence*. This

requirement arises in the fine grain, but intermittent, nature of the educational dialogs (established as requirements **R5** and **R10**). Together with the reality check of Section 3, which states that we do not have a 24/7 on-line service, this implies the existence of local state information at both learner and educator sites, with needs for synchronization between them at frequent intervals. In essence, the learner site needs to act as cache to the educator's site, with synchronization to make them coherent.

As an example of the mechanism at work, consider the following likely scenario. Having registered for study on a distance learning course, Jazz downloads the first teaching component from the eLT provider's web site. A week passes in which Jazz works, off-line, through the first course component. During this period, Jazz works through 10 SAMs, 8 of which are answered correctly. In the mean time, two course material updates have been made by the eLT provider: one affects the first course component (which Jazz has), one the second (which Jazz does not yet have). At the end of the first week, and having finished the first course component, Jazz logs on to the eLT web site to download the second course component. Via this link, information is passing both ways: Jazz makes a request for the second course component; an updated version is downloaded to Jazz's machine; without knowing the details of the transaction, but with permission, Jazz's SAM performance profile is uploaded to the eLT site; updates to Jazz's copy of the first course component are made to reflect the course updates, and Jazz is informed that this has occurred.

Over and above the downloading of the second course component, looking at this dialog in terms of caches, *cached information at both sites has to be made coherent*: from Jazz to eLT provider - to synchronize Jazz's SAM profile; from eLT provider to Jazz - to synchronize course materials. This mechanism will, moreover, form a critical component of the dialog between student and provider that will be present within many, if not all, educational software development projects. Because of its omnipresence, an architectural solution cache coherence between sites should be thought of as a basic service of the architecture.

The EdJB architecture incorporates a cache coherence service, as is illustrated in (Fig. 1b). The client tier now contains local 'persistent' storage for 'caching' local information, as well as its own *EdJB container* that wraps

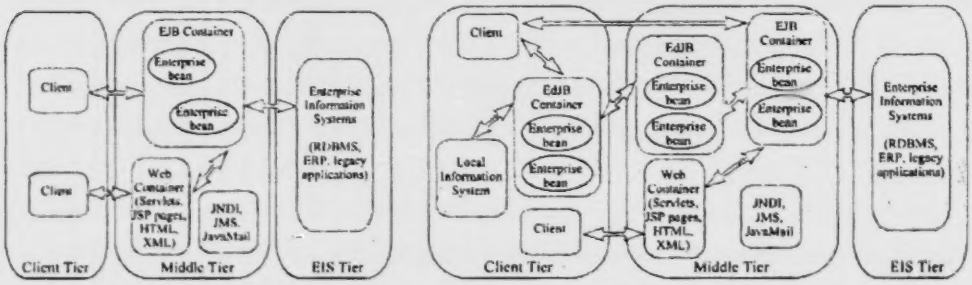

Figure 1: (a) The EJB architecture, and (b) The EdJB architecture

client business logic. This EdJB container provides cache coherence services through communication with a corresponding EdJB container in the middle-tier.

With the EdJB architecture, when off-line, the learner's interaction with the teaching materials will be through the Local Information System with the client business logic used to support it (by collecting SAM answers, for instance, etc). In off-line mode, of course, the middle and EIS tiers are not accessible for interaction. When on-line, the EdJB containers are joined so that client- and server-side data can be made coherent.

3.3. Does EdJB Satisfy the Requirements?

Requirements **R1-R10** constrain any architecture for electronic support of distance learning. We have proposed a blueprint architecture - EdJB - that we claim can provide this electronic support. The validation for the EdJB blueprint architecture against those requirements is argued in (Tab. 1)

R1, R3, R4, R6, R7	These are within the standard services provided by EJB for eCommerce
provide support for: **R2** *provide support for the use*	This is supported by the cache coherence services provided by the EdJB architecture. EdJB does not require the user to be on-line all the time, but

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of changeable teaching materials as the basis of the teaching provision **R9** *the delivery and updating of tutor notes*	ensures that both local and server information systems are made consistent as often as allowed by the end-user. This provides the mechanism for supporting changeable materials: materials delivered to the student (and so residing locally) can be updated as often as the student connects to the server.
provide support for: **R5** *provide support for periodic external study validation at a fine granularity* **R10** *provide support for fine grain interactions between tutor and course authoring team*	This is supported by the cache coherence services provided by the EdJB architecture. EdJB does not require the user to be on-line all the time, while ensuring that both local and server EJB copies are consistent as often as allowed by the end-user. This provides the mechanism for supporting fine grain study validation: student 'profiles' can be generated client-side and kept coherent with server-side copies. By making these available to the tutor, again through the caching mechanism to the tutors local cache, validation of the student 'profile' can be performed and returned to the student's local cache.
R8 *provide support for monitoring tutor performance*	This is supported by the cache coherence services provided by the EdJB architecture that provides the mechanism for supporting tutor monitoring - tutor 'profiles' can be generated client-side and kept coherent with server-side copies. Verification of the tutor's performance can be performed and returned to the tutor's local cache.

Table 1: Validation of the EdJB architecture against requirements

4. Discussion and Conclusions

In this paper, we have derived an extension of the EJB architecture that provides electronic support to the distance learning experience. We have characterized the architecture, EdJB, as *cache-coherent* EJB, in that each user has local storage (the *cache*) and supporting business logic (the *coherence*) to work with off-line. The architecture provides automatic cache coherence services whenever the user goes on-line.

We have argued that the architecture meets current high-level requirements in a distance learning setting. In this section, we will reflect briefly on a reinterpretation of the distance learning challenges that motivated cache coherence in the wider context of eCommerce.

Within an eCommerce setting, product maintenance is often also in the realm of the material world. However, there are instances where product behaviour profiles are feasible and useful. This is obviously true for software products, but could also apply to a wide range of appliances with embedded electronic components – say, the controller of a modern motor car engine or even a washing machine. We can consider the profiling of product use and performance as instances of a dialog in the EdJB sense. Working within the EdJB architecture, the development of *local* product use and performance profiles with cache coherence allowing regular updating of server-side copies is facilitated, as is the downloading of software updates, the alteration of operational parameters, *etc.*, from the server-side to the local cache.

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Web-Based Training System Using Exercises in German Linked with Online Teaching Materials

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Abstract: In recent years, a WWW-based CAI/CAL system has been needed as the Internet spreads rapidly. We also have been engaged in developing a WWW-based multimedia CAI/CAL system that supports to learn and teach foreign language. In this paper, we present a WWW-based training system that supports to learn German. This system, which enables the learner to learn the language at a level, has the following three features: First, this system is closely linked with WWW-based teaching materials (lexical and grammar materials) which we have devised, second, the teacher can edit exercises used in this system on WEB browser, third, the form of this exercises is often used in examinations of foreign languages at universities in Japan. This system, as a pilot project, has just been used by the students at our university.

1. Introduction

For the German language teaching at the university level in Japan, focus is on teaching how to make correct sentence structure. In the most of German language classes here, however, types of "grammar translation" method are still being used to teach the language, putting German sentences into Japanese and vice verse. Moreover, to learn how to make grammatical sentences, it is not only necessary for the learner to memorize the contents of the textbook but also to compose grammatical sentences.

We have developed a system using exercises in German ("Exercise System") to teach how to compose grammatical sentences, and another system to edit these exercises ("Editing System"). The form of the exercises is often used in examinations of foreign languages at universities in Japan. Because the teacher can offer her original exercises to the learner, the learner can study how to make grammatical sentences very well, and study German language more effectively.

These systems are placed on Web Page, both the learner and the teacher can gain access to these systems through the Internet from anywhere and at any time. (We are going to open these systems in this URL: "http://www.narita.elec.waseda.ac.jp/~harada/german/index.html")

2. System Configuration

The system configuration that we have developed is shown in Fig.1. In the server the following are stored: Exercise System, Editing System, the database for exercises and the database for lexical and grammar materials. In gaining access to this server through the Internet by using on interface such as WEB browser and Shockwave Plug-in, the learner uses Exercise System. Those exercises used in Exercise System are recorded in the database for exercises, and the teacher can edit the database by using Editing System. (It is necessary for the teacher to register her ID and password.) Moreover, because Exercise System is linked to the database for the lexical and the grammar materials, the learner can use both materials freely.

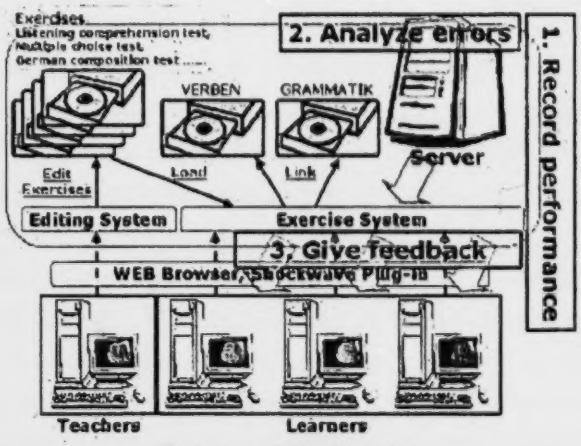

Fig.1. System Configuration

3. Features of the system

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3.1 Exercise System

In Exercise System, the learner can explore how to make good sentences by putting each word needed to make a sentence in the correct order by using a mouse. This system is closely linked with online teaching materials (lexical and grammar materials), the learner can study the meaning of a word, its pronunciation and grammatical features quickly at any time while learning the ways of making grammatical sentences. The learner can learn the language easily because multimedia such as movies, stationary pictures and sounds can be used within this system. We have exploited the traditional method of learning, such as translation exercises, by adding the multimedia functions to the Exercise System. Therefore, the learner can understand fully various features of the language. This system is developed by Macromedia Director 7.0J.

3.2 GRAMMATIK (Grammar Material)

GRAMMATIK is an online grammar material. By using GRAMMATIK, the learner can study the grammar with explanations and example sentences that relate to the sentence just composed by the learner in Exercise System. The learner can enhance her knowledge by using the GRAMMATIK, which is, so to speak, a textbook. The learner doesn't need any textbooks.

3.3 VERBEN (Lexical Material)

VERBEN is an online lexical material. By using the VERBEN, the learner will study the meaning of a word. At present, 100 most fundamental verbs are available, which were carefully chosen by teachers in WASEDA University. The learner can also study its inflection, its idioms and example sentences including the word. Moreover, the VERBEN gives the pronunciation of the word and the pronunciation of some example sentences for the word. The database for GRAMMATIK and VERBEN is designed by adapting Microsoft Access 2000, and the interface of these teaching materials is developed by Microsoft Visual Basic 6.0.

3.4 Editing System

Editing System enables the teacher to edit exercises used in Exercise System on WEB browser. After gain access to this system, the teacher can add, change, and delete contents of the database for the exercises stored in the server on WEB browser freely. (In the database the following are stored: question, answer, link to grammar material and lexical material, and so on.) The edited database is stored in the server again. The database for the exercises is designed by adapting Microsoft Excel 2000, and the interface of this system is developed by Perl 4.0.

4. Evaluation

At present, Exercise System has just been used on a pilot basis in an elementary German class at our university, and we take the evaluation of this system. This class is done three times a week, and about 30 students are attending each class. Their answers for the questionnaire on this system are shown in Table 1.

Effect of System	3.93 / 5.00
Operability of System	4.16 / 5.00
System Layout	4.13 / 5.00
System Speed	4.04 / 5.00
Functionability of System	4.02 / 5.00
Qualities and Number of Exercises	3.94 / 5.00

Table 1. Result of Questionnaire

5. Future Works and Conclusion

The present WWW-based training system has been introduced in this paper. This system is closely linked with the lexical and grammar materials. And, the teacher can edit the exercises on WEB browser by using this system. However, we want to improve this system based upon the above-mentioned evaluation in order to make this system easier-to-use to satisfy the needs and requests of learners and teachers. Moreover, as soon as Editing System is fully developed, we will develop a new system which can analyze the learner's errors and give feedback to her. In order to do this, we need to devise a function of recording the learner's performance. (For the development of the function to analyze the learner's errors, we are planning to use Neural Network etc.) At the same time, we want to improve the quality of the exercises (Ex. add the exercises of a new kind.) while the number of these exercises is increased.

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A Structured Approach to Teaching Web Development

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Abstract: Teaching students to become web developers requires a hands-on approach. Incorporating live clients into student projects, instead of using case studies or mock companies, adds a dimension that exposes students to the realities of web development. This paper will describe a structured methodology used in a web development course to build complete web sites for local businesses. Based upon the written evaluations included with the final project documentation, students feel this project is the most valuable learning experience of the course. Furthermore, the positive relationship established with the clients makes this project serve as a bridge between business and academe.

Introduction

Two years ago, the US government increased its estimate on the number of unfilled IT jobs from 1 million to 1.3 million (Baldwin, 1998). Haubold reports that each year there are more than 400,000 unfilled IT positions including programmers, systems analysts and IT specialists (2000). Paul reports that the demand for IT services is growing at 25 percent per year (1999). Nowhere is this trend more apparent than in web development. In 1994, three million people used the Internet. The number of Internet users was projected to grow to approximately 320 million by 2000, and to 720 million by 2005 (Meares, 1999). There are several reasons for such an explosive growth on the WWW: ease of publishing; relatively low cost of having a Web presence; low training needs because of the simple, link-based navigational model; ease in updating and distributing information; platform independence; and the potential of reaching a wide audience (Forsythe et al., 1998).

The architecture of the World Wide Web has evolved to the point where large and small businesses will have to be prepared to compete with those who employ Web-enabled business models to offer better responsiveness and a lower cost infrastructure (Taylor, 1998). Consequently, experienced people with web technology and management skills are in high demand and command high salaries (Violino, 1998).

Purdue University's Computer Technology (CPT) Department produces graduates who can immediately assume responsibilities as systems analysts, database administrators, webmasters, and application programmers. The primary reason for this employer confidence is that the CPT curriculum provides students with practical experience applying important concepts using popular, commercial technology. In the area of web development, students learn fundamental web development concepts and gain experience designing and implementing a real web site. Since web applications are a special-type of software, the web development process should closely model the software development process (Schulz, 1997).

Before teaching students traditional systems development, most curricula require students to develop programming skills. Likewise, before expecting students to build a web site, it is necessary to equip

them with fundamental web development skills. In the web development course, students are taught how to write HTML, JavaScript, VBScript, and DHTML code, and how to use Microsoft FrontPage and other tools to create web pages. Students also learn how to create image maps, forms, frames, tables, and style sheets. After discussing each of these topics, students complete weekly lab assignments to reinforce the new concepts. In addition to teaching how to use the technology, students are presented with a structured process for web site development. Throughout the presentation, there is major focus on the needs of both users and clients.

Web Development Methodology

Since the majority of students in the class are new to web development, it is important to provide them with a framework for the web development process. (See figure 1) The methodology employed in the class adapts features of traditional systems development methodologies to web site creation.

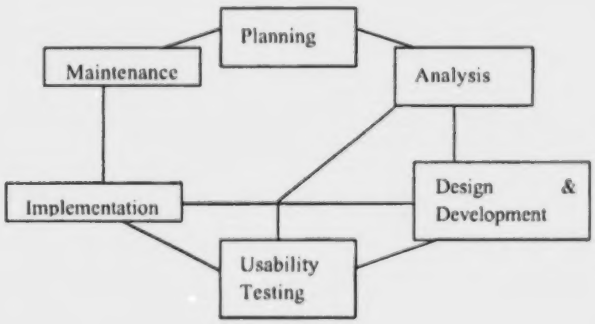

Figure 1: Web Development Methodology

The process begins with planning activities that include identifying the roles of each team member, defining who the clients and users are, and specifying the goals of the web site. Next, the proposed site needs to be sufficiently analyzed such that the developer can identify web content and organization as well as the anticipated process that the user will employ when visiting the site. Once enough details have been defined, the team should begin defining styles to be employed across the site for a consistent look and feel. This should also include designing individual pages, including graphics and multimedia. The design is frequently prototyped, so that initial user reaction can be collected.

The ease with which web novices can create a web site today and the potential value that a site can bring to the organization has resulted in an unprecedented number of sites. However, many sites have failed to realize their potential because they disregarded users' needs and requirements (Sano, 1996). For this reason, one of the most important elements of the project is the design of usability tests and analysis of the results. Students are encouraged to conduct usability testing throughout the project. In addition, they are required to include their usability tests in two separate milestones.

Based upon the results of the usability testing, there may be a need to update the design or even go back and conduct further analysis. These steps are repeated until the usability tests suggest that the site meets the user's expectations. Once that happens, the site is implemented on a production server. Usability tests should be repeated to insure that any unique aspects of the published site present no new problems. Again, the steps may be repeated as appropriate, until the client is satisfied that the site is complete. At this point, the client is educated on the maintenance activities such as registering with search engines and verifying that all links work.

Web Site Team Project

Once students have acquired fundamental web development skills through the weekly lab assignments and they know the recommended web development methodology, they embark on a team-oriented, web site development project for a real client. The project itself is divided into the following nine milestones to help the students follow the web development methodology advocated by the instructors:

1. Team profile
2. Company selection
3. Project proposal
4. Site design & resources
5. Prototype I and company feedback
6. Prototype II and usability test results
7. Web site presentation
8. Final documentation with team evaluation
9. Individual evaluation

Team Objectives

The preliminary task is to define the student teams such that each team has as close to the same background profile as possible. Students are surveyed about their related experiences and comfort level with a variety of web technologies. The instructors use the survey data to assign teams of 3-4 students with a balance of experience across all teams. For example, if only 20% of the students have substantial programming experience, each student would be placed on a different team, so every team can benefit from the programming skills of one member. Some team guidelines follow:

- Team members should have compatible schedules outside of class. To deal with this issue, each team is asked to identify three hours outside of class when they could have team meetings. Additionally, each individual team member is asked to identify three to seven hours outside of class to do work on the project.

- It would be helpful to have someone with *little to no* web development experience. It would be helpful to have someone with *some* web development experience. The instructors meet this goal by assigning students based on the results of the survey data.

- The team must designate a leader who will schedule and run all team meetings as well as serve as the team's spokesperson on communication with the instructor. The team must designate a company liaison that will be responsible for maintaining communication with the company representative. The team must designate a secretary who will record minutes from all meetings, and disseminate to all members and instructor. Teams are permitted to alternate this role, but this must be documented. The students determine their roles after their initial meeting.

- Each team member must maintain an individual log of activities related to this project. The logs may be checked each week in class and are a required part of the final project report.

Client & Web Site Objectives

Once the team has been assigned, they must identify an organization that wants to develop a presence on the Web. The organization can be a for-profit business, not-for-profit company, student club, etc. The scope of the web site should be neither too broad nor too trivial. Students are not expected to build an exhaustive web site that allows the company to conduct all of its business through the web site. Likewise, there is little value in developing a web site that documents a minute, unimportant, uninteresting aspect of the company. The teams have to find a balance that considers their schedules, the total calendar time allotted to the project (approximately 10 weeks), and their web development skills. To abet the students in this area, the instructors define minimum web site features that constitute 75% of the project requirements. The student team, in collaboration with the client, determines additional relevant features to add to the site for the remaining 25% of the project.

Minimum project requirements

The minimum project requirements are objective and fairly easy to meet. In the past three semesters that the course has been taught using a live project, only one team failed to meet all of the minimum project requirements. These requirements include:

- The complete site must include at least 10 web pages
- The home/main/start page must provide internal web site links as well as related links to external sites.
- A formal navigation standard should exist across the site (frames, buttons, menu bar, etc.).
- User information should be collected after validation assures acceptability of data.
- The site should provide company contact information (name, address, phone, fax, email).
- Any external resources used should be credited.
- The web pages must use the user's vernacular.
- The pages must be arranged in a logical fashion.
- Unnecessary or irrelevant information must be omitted.
- Images should be used, where appropriate, to convey more meaning or attract attention, but not at the expense of too much load time.
- Usability tests should be conducted throughout the project to support the point that the site continues to meet the user's needs.

Additional project features

The greatest challenge that students face is determining what additional requirements should be incorporated into their site such that they bring value to the client and target users and the challenge level warrants additional credit. To help the students with this subjective part of the project, the instructors demonstrate past student projects as well as give the students a list of possible enhancements that could qualify for the remaining 25%. The list of suggestions shared with students is below:

- Employ an image map to increase appeal and provide an alternative for linking to elements within the site.
- Incorporate security to restrict access to the entire site or to some elements within the site.
- Customize the user's experience through maintaining user data in a server database and modifying pages based on the user's profile.
- Add a floating, drop-down menu to provide access to site options without having to scroll back to the top to access the menu.
- Add relevant games (word search, hangman, tic-tac-toe, etc.) to give users a reason to return to the site.
- Add Flash movies to initially gain the new visitor's attention.

Since much of the project's success is dependent on the client, the students must identify a cooperative representative within an organization who is willing to work with them on a regular basis as a resource as well as to provide feedback throughout this project. On the second milestone, students must document this person's name, phone number, email address, role within the organization, and expected role on their project. More importantly, students must include a memo from their proposed client to the instructor accepting the role that the team has defined. If students have difficulty finding an organization, they contact the instructor to find out about any other potential clients that may be available for the project.

Project Proposal

Once the team has completed initial project planning, they must thoroughly analyze the proposed web site needs and expectations. Before they are officially allowed to develop the site, they must seek permission from the instructors by documenting their complete analysis in a project proposal. This document is written as an executive summary memo that addresses the following points:

- a 1-2 sentence statement of the proposal
- general description of the company and statement of needs for proposed web site
- outline of work to be completed, including strategy methods and criteria for collecting web site data
- development team with individual responsibilities to demonstrate that each member will be contributing equally to the project
- justification for the Web site, such as potential value of the final system
- sources of knowledge
- user profile
- benefits to all persons including the student, company, company representative, and target users
- evaluation strategy
- anticipated problems

As long as the above points are adequately addressed and all web site proposals are for different organizations, permission to pursue the proposed project is granted. However, no team member may serve as the company representative. Based on feedback from the most recent course offering, at least one student felt that no student member should be affiliated with the client organization. This is a recommendation that will be considered for subsequent semesters.

Site Design and Resources

Assuming that the proposal is accepted, students should immediately begin designing their client's site. The design must include the layout and organization of pages on the site, consistent header/footer content, and related external links. Although the design may be sketched out on paper, the majority of teams tend to use a tool such as Microsoft® FrontPage to build a prototype.

Initial Prototype and Company Feedback

Much like any other systems development project one of the most valuable things that the teams discover is that their clients are not very helpful in specifying what the sites should look like or how they should behave; however, the clients can definitely tell them when they do not like something. This helps the students recognize the value of soliciting formal and regular feedback. Therefore, once the design has been approved, each team submits its initial site prototype along with the written feedback from the client.

Prototype II and User Test Results

As previously stated, many sites have failed because they did not consider the user's needs. To address this, the teams submit their second prototype with a status report that documents their usability tests. The report must include a description of their test strategy, include samples of the user tests, include the actual data, and their analysis of the results. Although studies have shown that the optimum number of test users is five (Nielsen, 2000), the minimum requirement is ten. This helps the students realize trends and account for different groups of users.

Team Presentations

During the semester, every team is developing a site for a different client with unique objectives. One of the most interesting milestones completed by the teams is a presentation of the site to the rest of the class. Every team member is required to actively participate in the presentation. Minimum content requirements are given to the students prior to their presentation. The presentations are timed (4-6 minutes due to limited class time) and videotaped. Finally, the presentations include a demonstration of the major elements of the site. Since the presentations are completed at least one week prior to the final submissions, many teams are able to get peer feedback and ideas for the additional features that can help improve the site for the client and target users.

Team and Individual Evaluations

Once the project has been completed, students must document their experiences in a team evaluation report and confidential individual evaluations. The team evaluation includes a discussion of each student's contribution to the project and team, individual and combined lessons learned, value added through the additional features, possible future improvements, and remaining implementation activities discussed with their client. The final set of usability tests and their analysis, along with the final client evaluation are also included. The individual evaluation allows each student to share confidential comments regarding the team interaction and contributions by teammates.

Conclusion

Based upon the written evaluations included with the final documentation package, students find this project to be the most valuable learning experience of the course. Every semester that this methodology has been employed, students have been sought after for their web development experiences, often times by the web clients from the semester project. In a few cases, the clients have recommended to others that they volunteer to serve as clients for subsequent semesters. Accordingly, this project serves as a mechanism for bridging business and academe.

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Criteria for Evaluating Foreign Language Teaching/Learning CD-ROM Texts

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In this poster session I would like to demonstrate criteria for evaluating foreign language teaching/ learning CD-ROMs. This researcher also hopes to gain valuable feedback, from conference attendees, on how to improve the selection and review of new language learning CD-ROMs.

VoiceXML Builder: A Tool for Creating VoiceXML Applications

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Abstract Currently, the most common interaction with the Web is visual and accomplished using a keyboard or mouse. While sound files can be incorporated as part of the presentation, the user cannot interact with a Web page using speech. This orientation limits the mobility of the user and his interaction with the Web because both hands and eyes must be involved in the task. The use of speech recognition and synthesis will remove this limitation and promises to be the next wave in Web interfaces. Speech technology will promote an increased use of the Web in, as yet, untapped environments in a similar way that cell telephones have promoted an increased use of telephones. One limitation to the development of voice systems is the lack of easy-to-use tools for creating spoken dialogue systems, particularly by non-experts who have no experience with or desire to learn the low level details of speech technology. A promising emerging technology for solving this problem is VoiceXML. VoiceXML is an XML-based markup language that brings the Web and content delivery together in voice response applications in an easy-to-use manner. This paper presents an editor for creating VoiceXML documents and narrates the research behind the tool.

Introduction

Currently, the most common interaction with the Web is visual and accomplished through the use of the keyboard or mouse. While sound files can be incorporated as part of the presentation, the user cannot interact with a Web page using speech. This orientation limits the mobility of the user and his interaction with the Web because both hands and eyes must be involved in the task. In fact, most pervasive computing devices today are used in a hands and eyes busy mode. The use of speech recognition and synthesis will remove this limitation and promises to be the next wave in Web interfaces. The use of speech recognition frees the user from the windows, icons, menus and pointers (WIMP) interface. It will enable the user to interact with the Web in a hands-free or mobility required manner (e.g., while traveling in the car) with no manual intervention [1,3,7]. Speech technology will promote an increased use of the Web in, as yet, untapped environments in a similar way that cell telephones have promoted the increased use of telephones.

Currently most of the speech interfaces are similar to telephone response systems in which the user is expected to enter a preset number from a menu of choices. While these systems are commonly used today, these systems have been viewed as limited because the user must remember the mapping to keys, there may not be an appropriate option, and navigation must proceed through a prescribed set of options, even if the user knows exactly what he wishes to do [1].

A review of the recent literature indicates that researchers are working diligently to understand speech interaction and when its use is most successful. Several recent articles have reported on studies of

the voice interaction of humans with computers and how to make speech interfaces more conversational and adaptive than voice response systems [1,2,4]. In one of these articles, Schneiderman concluded that an understanding of the cognitive processes utilized in speech will aid interface designers in integrating speech in a more effective manner. Schneiderman also indicated that future uses of speech in Web environments will not be as standalone components, but as complements to visual interfaces as part of a multimodal interface [6].

One of the current limitations in developing voice systems is the lack of easy-to-use tools for creating spoken dialogue systems, particularly by non-experts who have no experience with or desire to learn the low level details of speech technology [2,3,6,7]. This lack of tools inhibits the development of applications and the portability of existing applications. It also results in a scarcity of skilled application developers and high costs of development and deployment [3].

One of the most promising emerging technologies for solving this problem is VoiceXML (Voice eXtensible Markup Language). VoiceXML is an XML-based markup language that brings the Web, content delivery and voice response applications together in an easy-to-use manner. XML is a specification for designing markup languages that are used on the Web. It is a metalanguage that is an accepted standard for providing structure to Web documents.

XML documents consist of data and markup components (e.g., element tags, processing instructions, data elements, comments, etc.) that are parsed and interpreted by an XML processor (such as a Web browser). Each component of an XML document (e.g., page, image, audio clip) is stored independently from the document. SMIL (Streaming Media Integration Language) and VoiceXML are just two of many XML vocabularies that have been developed. Currently, there are a limited number of browsers that support XML documents, but both Netscape and Internet Explorer have committed to supporting XML 1.0 [5]

VoiceXML was released in March 2000 and accepted in May 2000 by the World Wide Web Consortium (W3C) as a basis for developing a dialogue markup language for voice [8]. Basing VoiceXML on the existing standards of XML (eXtensible Markup Language) has the benefits of allowing the re-use and re-tooling of existing tools for creating, transforming and parsing XML documents. Several vendors including IBM and Motorola have implemented versions of VoiceXML 1.0 [8].

The purpose of this paper is to describe the a prototype for an easy-to-use editor for creating VoiceXML documents that is called *VoiceXML Builder*. Such an editor allows novice users, as well as experienced ones, to create or edit Web-based speech systems easily. The objectives of the project to develop *VoiceXML Builder* included (1) determining the attributes of an effective voice interaction interface, (2) identifying the components that are needed in an editor for developing VoiceXML applications, (3) designing an interface and supporting system for a VoiceXML editor that incorporates the components identified in objective two, (4) developing a prototype editor, and (5) testing the effectiveness of the editor in creating VoiceXML applications.

Voice XML Builder—the Editor

In developing *Voice XML Builder*, an editor for VoiceXML applications, the first step was to determine the attributes of an effective voice interaction interface. Current voice response system dialogues represent paths through a decision tree. An investigation of approaches to the representation of a voice dialogue in the development environment was conducted. Because the editor interface is visual, a review of the literature on the development of graphical user interfaces was also conducted in this step. Since VoiceXML

dialogues are not visual, the usual procedure used in developing graphical user interfaces by laying objects out in a window as they would appear in the interface was not deemed to be appropriate

The next step was to identify the components that were needed in an editor for voice applications using VoiceXML. During this phase of the project, a review of the VoiceXML syntax and existing language editors, were conducted to decide what support was required in an editor for creating VoiceXML applications.

Standard systems analysis and design methods and tools were used to design the interface and the software components of the editor. The design approach was object-oriented so that components could be easily modified and new features easily added to the system at a future date.

The resulting interface has some attributes that are typical of many language editors. It contains a text area for entering and displaying code as well as a toolbar for performing standard tasks such as opening and saving files, copying and pasting segments of text, and searching for text. The editor also includes a toolbar button for getting help. The basic interface is shown in Figure 1 below, and some of the editing features are illustrated in Figure 2.

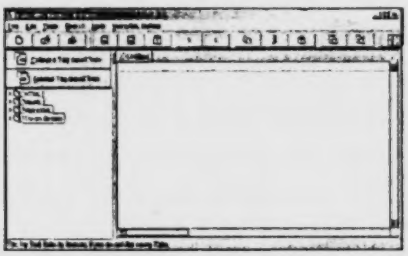

Figure 1
Interface

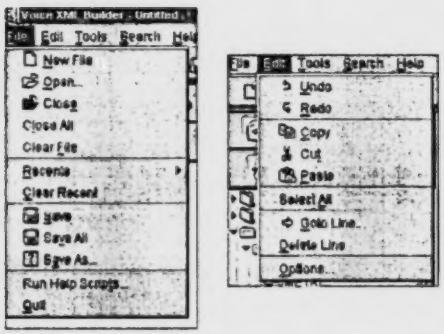

Figure 2
Editor functions

There are several unique features of the editor. First, the left side of the editor interface (see Figure 4) contains a list of elements that can be used in creating a VoiceXML application. By clicking on a selection from this list a template of that item is automatically inserted into the code in the window. A partial list of the element choices is shown in Figure 3.

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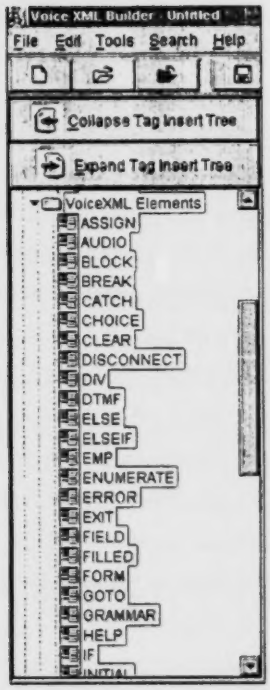

Figure 3
VoiceXML element templates

Second, the key words in the VoiceXML syntax are highlighted in different colors to illustrate what types of constructs they are. For example, tags are highlighted in blue and variable names are highlighted in red. Figure 4 illustrates this feature.

Figure 4
Editor features

The Options selection from the Edit selection on the main toolbar allows you to change the colors that are used to highlight the different code components. The Options selection contains multiple tabs for altering

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general features of the editor as well as colors, filters, and styles. The muli-tabbed dialogue box is shown in Figure 5.

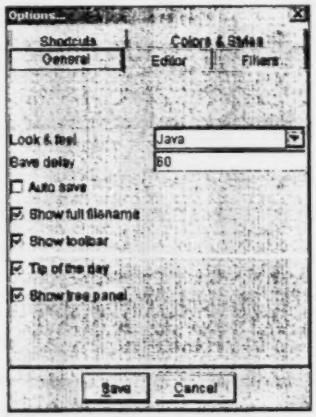

Figure 5
Modifying editor features

In addition to supporting the development of VoiceXML applications, *Voice XML Builder* supports the development of VoxML (Motorola's XML vocabulary) applications and HTML applications as well. VoxML is the Motorola version of a markup language for describing voice interactions.

The language used for developing the VoiceXML editor was Java since it is portable and readily supports the development of an object-oriented system. The current version of the editor is a Java application. The editor was developed and tested using a personal computer, although the code was developed using the JDK1.3 (Java Development Kit) which makes it possible to develop and execute the editor on any platform that has JDK1.3.

Several small applications were identified for development in VoiceXML and created using the editor. For each, a list of predicted behaviors and outcomes was manually generated. Since the current versions of Netscape and Internet Explorer do not support VoiceXML applications, each application was tested within a specially designed VoiceXML enabled browser. For each program, the execution behavior was matched to the predicted outcome. A sample program is shown in Figure 6.

```
<?xml version="1.0"?>
<vxml version="1.0">
        <form>
  <block>Hello World!</block>
 </form>
</vxml>
```

Figure 6
Sample Program

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Summary

As Web-based voice applications become more common in our homes, offices, and vehicles, the need for tools for developing those applications will become more acute. *Voice XML Builder*, an editor for the creation and modification of VoiceXML applications that is described in this paper, was designed and developed to help meet the need for software tools to assist in the development of voice applications for the Web.

Acknowledgements:

The authors would like to acknowledge and thank Arturo Ramirez, a master's student in Applied Computer Science, who developed the software *Voice XML Builder*.

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Matching the Infoverse: About Knowledge Networks, Knowledge Workers, and Knowledge Robots

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Humans are not able to cope with the exponential growth of information and the increasing speed of information and business processes fostered by information and communication technologies. Technical support not only for information storage and retrieval but also for information selection, process planning, and decision support is needed. Moreover, the use of a (desktop) computer is restricted in many ways. In this paper, it is predicted that smart and mobile computing units embedded in a variety of things, such as TV sets and cars, will bring computing power close to their users. It is also predicted that users will get closer to computing power by using natural language and by using their social skills in computer mediated communication. A holistic architecture of knowledge robots (knowbots) is described based on multi-agent platforms and distributed computational intelligence. Knowbots consist of a self-learning artificial brain, speech recognition and synthesis, direct access to other software agents and computer programs, and direct connections to networks of human users. It is pointed out that a newly defined partnership between men and machine is a possible way to keep control of the exploding 'infoverse'.

Reasoning and simulation mechanisms of currently unthinkable complexity will take over the control of process planning and information exchange. Fourth generation robots with the capability of performing more than 30 million instructions per seconds (MIPS) will be the heart of a company's knowledge base. This is the vision propagated by Hans Moravec, Principal Research Scientist at the Robotics Institute and Director of the Mobile Robot Laboratory of Carnegie Mellon University, Pittsburgh (USA).

The global economy gets accustomed to the idea of the 'new economy' where the knowledge workers' creativity and skills are the companies' most important capital and competitive advantage. If only parts of Moravec's vision come true, however, it will certainly mean that the relevance of human expertise and experience will diminish. Current developments seem to support this point of view: A supplier of computer storage systems reports that especially banks are consuming more storage space within six months than has been used during the last twenty years; the increasing speed of product innovation and life cycles depreciate technological knowledge and skills within one to three years.

The 'infoverse' stored in the worldwide Internet starts to exceed the amount of information that has been stored in more than 60,000 years of human culture before: It has been estimated that in the years 1972 to 1980 more information has been collected than in the 2000 years before. Fifty years after the publication of the first Gutenberg bible about two million books had been published; today, more than 3000 books are published per day, more than one million per year. Some authors, therefore, are discussing the advent of the 'age of knowledge'. Others, however, argue that the Internet is not more than a gigantic heap of information garbage.

Recent studies show that we are not able to remember more than one to two percent of all the information we perceive in the mass media, such as radio, TV, or newspapers. A single search engine covers not more than about twenty to thirty percent of the World Wide Web pages, meta-search services using more than one search engine comprise about fifty to sixty percent of the WWW pages. Even the best text searching and indexing techniques do not come up with more than 25 percent of relevant links or search results, that is, an optimal search process accesses a quarter of a half of the information in the Internet - and one or two percent of this information can be remembered. Thus, we have to state that we have lost control over all the information gathered in technical systems.

Exponential growth of information, information access at light speed and the increasing speed of business processes and the decreasing value of human knowledge force to re-focus the development of information and communication technologies (ICT). Information accessibility is no longer the main concern, but navigation, orientation and selection of relevant information. As computers and robots provide us with incredible capabilities to process increasing amounts of data within decreasing periods of

time, it seems clear that we can only master the self-made 'information overload' if we manage to enhance our skills by developing a real computer-man dialogue and partnership.

The key topics of this new level of CMC (computer-man communication) is a mobile, ubiquitous and selective information access enabled by smart software agents based on multi-agent platforms using distributed computational intelligence. We are now at a turning point in our cultural development where sustainable progresses can only be made if we are able to delegate information retrieval, process planning and decision support to technical systems. We have to decide whether we want to become garbage collectors within heaps of information - or the human masters of smart agent systems which we do not fully understand.

If it works, it's not AI

Up to now, the progresses of the so-called Artificial Intelligence (AI) have been disappointing. A recent study about the commercial success of AI startup companies comes to the conclusion: 'If it works, it's not AI'. This assumption has been reflected in the revenues of AI corporations during the last decades (cf. figure 1). The strong position of AI is to develop machines that are intelligent in a human way. The weak position of AI is to implement programs that can be viewed as 'partly intelligent' because they are able to perform actions that used to be dedicated to human workers. This mode of AI is now referred to as 'Computational Intelligence' (CI). Patricia Churchland pointed out that we are at a stage where the strong AI position tries to mimic human intelligence in the same way the first pioneers of flight tried to mimic the birds' way of flying. As no modern airplane or helicopter is flapping its wings, it is clear that solutions enabling flight are not relying on flapping wings but on a proper lift. So, what might be a way to lift the weak position of AI to a higher level?

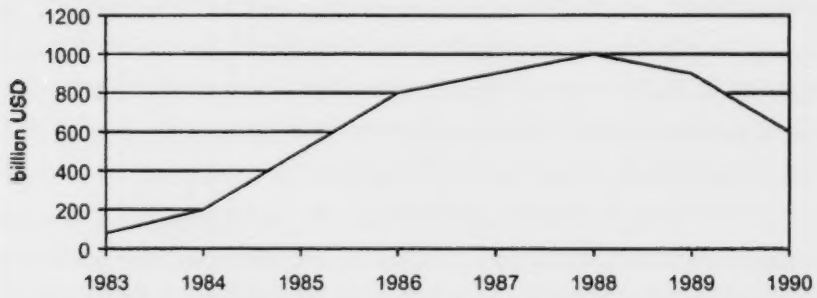

Figure 1: Approximate AI revenues (Philipps, MIT, 1999).

In 1998, the non-profit association 'Institute of New Media' and Bank Academy, a non-profit educational institution of the German bank associations, formed a joint venture to implement and test new ways of autonomous software agents which could help learners and knowledge workers in information intensive industries, such as banking and finance. At the beginning of the year 2000, Knowbotic Systems Inc. Ltd. was founded by the Institute and the Bank Academy. The purpose of this company is to develop and to examine knowledge robots or 'knowbots' which help to fully exploit the knowledge capital of a company by facilitating information selection, planning and decision making. The mission of Knowbotic Systems relies on two basic assumptions: (1) As long as key concepts, such as 'learning' and 'intelligence', are not fully understood and clearly defined, computers won't be intelligent learners. Therefore, a formal learning theory has to be deduced from recent theories and empirical studies in order to set up a virtual testing environment for knowbots which helps to measure their adaptability and to extend their learning capabilities. (2) The critical lift of CI will not come if a system is intelligent in itself, but it comes from the human capability to communicate with such a system in a intelligent and social way. Thus, knowbots have to mimic intelligent communication behavior in order to transfer the results of machine learning and machine reasoning to human users (cf. figure 2).

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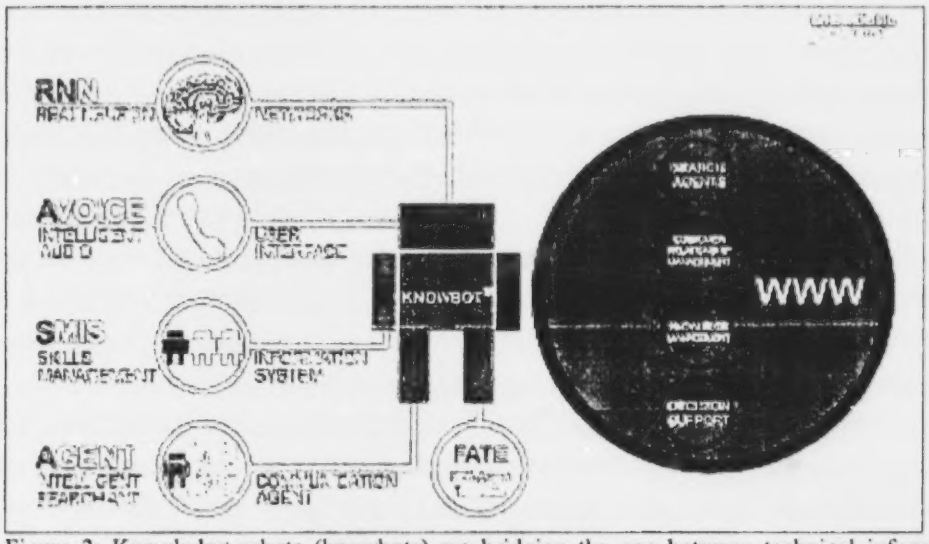

Figure 2: Knowledge robots (knowbots) are bridging the gap between technical information and data collections (right) by using artificial brains (RNN), ears and voice (AVOICE) and connecting information (AGENT) and people (SMIS) based on the multi-agent platform FATE.

The artificial brain

Most programs which mimic intelligent behavior are based on logical oriented knowledge-based techniques which proved to be too inflexible to represent even primitive forms of learning. Moreover, they elicit a number of paradox behavior when applied to support human learning. In classical AI different forms of logical based representational schemes are used and in connectionism researchers adhere to different types of artificial neural networks (ANN). ANNs have achieved some success in non-linear forecasting, pattern matching and in artificial life paradigms. But ANNs still lack many of the vital features of biological neural networks (BNN), such as the ability of real neurons to allow self-modification with regard to short term and long term learning. The simulation of BNNs developed by neurobiologists does not seem to be promising either because recent attempts have shown that exact simulations of neuron brain cells consume a vast amount of computer resources. For instance, 18 hours of computing time on five connected Sun Sparc workstations is needed to simulate one second of the activity of a single neuron.

Knowbotic Systems combines the behavioral perspective with the physiological perspective, both embedded in concepts of learning and sign based communications (or Semiotics). We call these self learning and sign-using systems 'knowbots'. The physiological structure is the main cause for observable behavior. Thus, we have to find a model of the human brain neuron which should be empirically more sound than the classical ANNs and should also be still practically feasible on 'ordinary' PCs. Knowbotic Systems' RealNeurons® almost perfectly simulate human brain cells with respect to the height of the potentials, the timing of the processes and the concentrations of chemical substances involved. Moreover, our neural networks can model the local and global influence of hormones and psycho-pharmaceutics on brain cells. We are modeling only those properties of biological cells which are most likely underlying learning of new behavior patterns.

Only a few BNNs underlying learning, however, have been identified yet. As a first test case we have chosen a classical conditioning circuit and several candidates that might be responsible for operant conditioning. In first experiments we implemented the network which represents the eye blink reflex of a rabbit. The network matches the neuropsychological data almost perfectly (cf. figure 3): The connection of the unconditioned stimulus (US = air flow) and the conditioned stimulus (CS = sound) is learned in a few trials, if the CS is given slightly before the US. Several runs presenting the CS without the US extinguish the connection. It is re-established very quickly, if the CS and the US are displayed together

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again. This means, that not only the neuro-biological structure of brain cells can be simulated on a PC, but also basic learning behavior which perfectly matches empirical data.

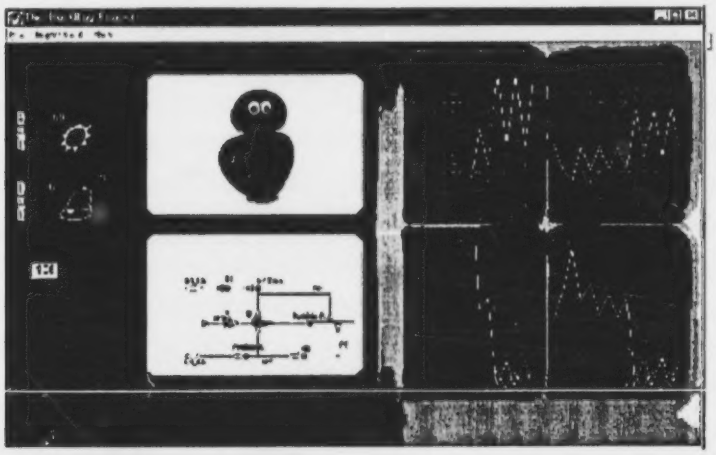

Figure 3: Test environment for (classical and operant) conditioning experiments with Knowbots based on artificial biological neural networks implemented with Java.

The artificial body

The artificial brain cannot communicate to humans and environments without a body. Robotics' research has shown that intelligent or adaptive behavior is based on a close interaction with the outside world. Moreover, the measure of learning or intelligence clearly depends on observable behavior corresponding to well defined learning tasks and environments. Knowbotic Systems, therefore, concentrates its technical developments on interface technologies which facilitate the access to knowbots by human users. The most important way to communication is speech. Knowbots are equipped with the speech recognition and synthesis system *AVOICE*. The speaker independent speech recognition is able to identify about fifty words in five different languages at a time. As the word recognition can be adapted according to the actual context, this small amount of words is sufficient to implement small navigational or command systems. The speech recognition unit may also be trained to understand a specific user and it is then capable to handle dictionaries of several hundreds or thousands of words. The speech synthesis can read any text, such as HTML pages, tables or documents. The user can choose between several 'speakers' with different pronunciation or intonation. In summary, AVOICE equips knowbots with a - still limited - human ear and voice. Knowbots, therefore, connect their users directly to all the information stored in the Internet, regardless whether they hook onto the Internet via a computer, a telephone, or a mobile phone.

Knowbots can also move around in the Internet, access data bases and organize their user dialogues. This is done by *AGENT*, an intelligent search agent and dialogue manager. The search agent is able to act as a search robot and a crawler in the World Wide Web. It can also get access to data bases or transform graphical information into text information. Thus, AGENT provides knowbots with a variety of ways to 'perceive' the virtual infoverse of the Internet.

The artificial environment

Up to now, there is much more talking about the irreplaceable value of the human capital and knowledge than taking actions to maintain and support the development of this capital. Most technical systems concerning the human capital of a company focus on the administration of personnel and training, such as SAP Human Resource modules, Peoplesoft or SABA - just to mention a view of them. An US-American study lists about 300 systems for training administration and delivery. But finding matches of needs and

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demands in the infoverse certainly means more than matching keywords to indices or user profiles to software agents. The knowledge economy is not so much about information, it is about people. Knowbotic System is, therefore, engaged in a jointly initiative of several partners to implement a Skills Management Information System called 'SMIS'.

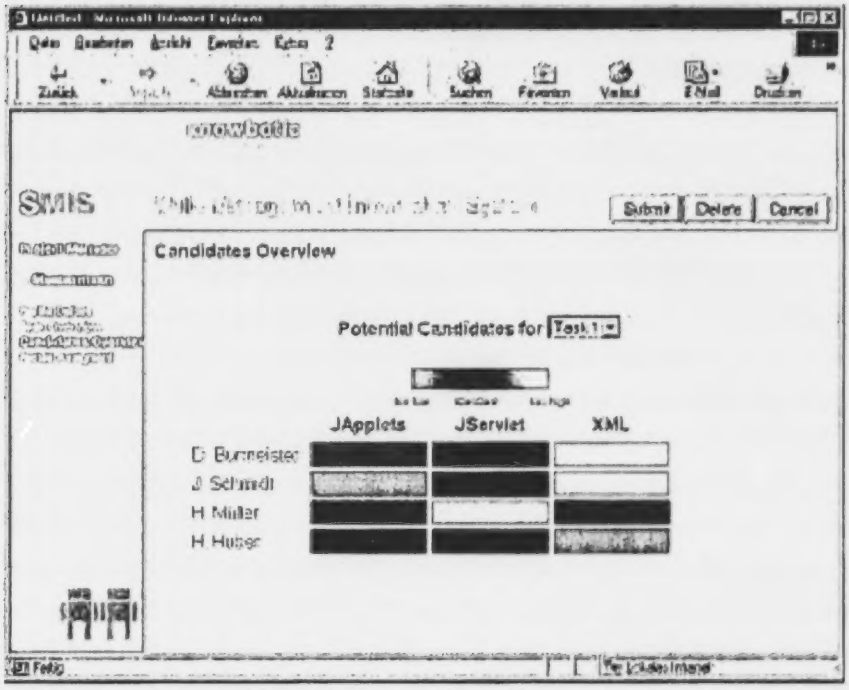

Figure 4: Screen shot from the Skills Management Information System 'SMIS' - the candidates overview lists possible candidates for a project tasks in acolored table indicating skills below or above the standard.

Human users, the users of information systems, visitors and creators of the infoverse, are the main 'component' of a knowbot's environment. Additionally, other knowbots or standardized software agents may also enrich the knowbot environment. For this purpose, Knowbotic Systems has developed one of three worldwide available multi-agent platforms based on the FIPA standard (FIPA = Foundation of Intelligent Physical Agents). The platform *FATE* (FIPA Agent Template) comprises templates or suits which allow programmers to convert nearly any computer program into a software agent, that is, the knowbot technology provides easy-to-use ways to introduce a large variety of programs into the virtual learning environment. FATE also allows to run several platforms on different Web sites. This enables knowbots and other agents to communicate, move or replicate themselves all over the World Wide Web.

The (artificial) future

We envision future developments in networked computing and distributed computational intelligence where the users are no longer forced to adapt to the computer. The computers will adapt to the human capabilities to perceive and process data. The communication between and with computers will adapt to the human way of communication, namely natural language. And computers will be accessible at any time from any point with any device, such as handhelds, laptops, or mobile phones. Computer networks will also become people networks, taking into account specific deficits and potentials of computers and humans.

Knowbots are one of the few holistic visions of a man-machine dialogue in its actual sense, dedicated to support humans where they need help to access and select information - and to learn from

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them. But knowbots are not the only development in this field. A new level of smart agents and self-learning machines will develop in the near future. Figure 5 summarizes some major developments which are expected in the near future. Among them are software agents, mobile computing, and speech control. But, most of the forecasts of technological growth and development turned out to be too conservative.

2004	2005	2006	2007	2008	2009	2010
Ubiquitous online learning in universities	Online learning in schools (K12) Interactive communities in the WWW Increasing use of eCommerce	Software agents to search and select information Interactive TV for big audiences	Increasing use of speech recognition and synthesis Central remote control station for 'intelligent buildings'	Increasing use of electronic cash Broadband access to information	Mobile computing and eCommerce	Self-learning software agents 3D virtual reality

Figure 5: Some major developments in interactive media in the next ten years according to a recent study of the Fraunhofer Gesellschaft (Institut für Systemtechnik & Innovationsforschung).

Up to now, many individuals and companies are fascinated by the potentials and the exponential growth of the Internet. We do not think that future generations will be too enthusiastic about slow networks, unstructured information heaps and poorly equipped online shopping malls. Smart computers will be part of our every-day life, will be part of houses, cars, TV sets, refrigerators, bags, and suits. As a matter of fact, many ordinary machines are based on so-called embedded systems, that is, a small specialized computer. So, the things start to become computational things - and they will be smart things in the future. Knowbots and other smart agent technologies will support work, leisure and even cultural or social entertainment. Computers in the form of smart things will make computational intelligence as ordinary as cars or TV sets. But if the computers get nearer to their users, at the same pace the humans will get nearer to the computers: Not individual human beings nor software agent platforms will be the masters of the infoverse, but partnerships of robots, knowbots, and humans.

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The Use of QUEST-based Multimedia Units as a Supplemental Inservice

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Abstract: Alternatives for inservice training need to be developed to accommodate ongoing certification renewals and legislative actions requiring inservice for regular teachers new to inclusive classes. This session will demonstrate the feasibility of stand-alone multimedia that can be designed to fit a local school system's specific inservice/instructional training needs while enhancing participant's long-term learning.

In the state of Texas, all new certificates issued since 1999 require continuous inservice training for renewal. Thus far, this inservice has been provided by a combination of regional Education Service Center inservice offerings, in-house training, professional conferences, and course offerings in regional institutions of higher education (IHEs). As the number of new teachers grows and new legislation is enacted requiring additional inservice for those regular class teachers new to the inclusive environment, the current options for the inservice needed will not be sufficient.

New technology and its accompanying software now permits effective internet-based instruction using hypermedia learning environments in synchronous or asynchronous format (e.g., Fitzgerald & Semrau 1997; Spooner, et al. 1998). For the past three years, I have been developing multimedia modules combined with live videoconferencing, chat room and discussion board use within a distance training program specifically designed to develop bilingual educational diagnosticians in rural settings along the Texas/Mexico border corridor, i.e., Project DEED, Distance Education for Educational Diagnosticians (Hausman, 2000; Hausman et al. 2000). The multimedia modules have also been incorporated within my on-campus classes for the past two years, with excellent results.

Interactive, multimedia modules can provide a flexible, efficient, linear as well as nonlinear and associative learning environment useful for a wide range of learners. Current multimedia production software programs, e.g., Authorware, QUEST, Director, also permit the development of stand-alone multimedia customizable for specific systems' as well as individual learner's needs that can be provided via CD-ROMs. There is an emerging variety of formats that permit selection of approach a learner may prefer, e.g., case-analysis based, linear/directive/factual approach, etc.

Although hypermedia may not be suitable for all learners (Liu 1994), it would appear that this approach, designed for inservice rather than preservice training, may prove an excellent addition or supplement to the other approaches already in place to provide the needed inservice training required by IDEA (1990, 1997) as well as by recent state legislation. This approach would also seem to be particularly useful to Special Education Directors in that a library of multimedia CD-ROMs would be easily organized and distributed as needed. In addition, multimedia modules can be designed and constructed to cover specific topics targeted by the program directors.

A further advantage associated with a modular approach involves the record keeping system that is feasible. These modules should be made interactive in nature, hence, any and all responses by the user to the program (even the time taken between responses) may be stored in a separate file under the user's name or identification number for later print-out or forwarded to the Director's or personnel office for printing/analysis. The resulting hardcopy could then serve as documentation of the successful completion of a unit, the time taken to complete the unit, and/or an individual's need for additional training in specific areas.

The approach I have been using to produce the modules for Project DEED has been based on use of the QUEST software, a multimedia production utilities program developed by Mentergy (formerly Allen Communications) of Salt Lake City, Utah. This software program, once mastered, allows the production of multimedia modules that are far more interactive than, for example, PowerPoint. Any media can be used within QUEST, e.g., text, illustrations, graphics, graphics animation, audio/visual stimuli (still, animated, or video clips), etc. The product is limited only by one's own skill with the software and one's imagination.

My students enjoy the use of colorful, highlighted points for emphasis, with clean, clear concepts highly illustrated (where feasible), accompanied by descriptive text blocks (for those preferring visual content to auditory input), using movement to attract attention. Some prefer 'cut and dry,' factual statements, others prefer some type of hands-on activity to accompany the presentation, while there are those (myself included) who enjoy adding a story-telling approach or element to the modules, thus providing room for structure as well as individual flexibility. Through the use of extensive menus and submenus, those who enjoy a linear approach to a topic may progress through 'frame by frame,' while others may wish to jump around to subtopics of primary interest to them, and still others may wish to initiate a project of study with an orienting pre/post test. All of these types of learners can be accommodated within a well-designed QUEST based module.

The 'released' version of the completed module is a 'stand-alone' unit that can be burned on a CD-ROM for use in any IBM compatible computer, without the need for additional resident software. Module updating simply requires insertion of new information in the master copy and re-releasing the unit ... a "MUST" to accommodate all of the litigation-mandated changes in our field, i.e., special education.

Thus far, the modules have proven effective for direct, facilitated instruction (e.g., accompanied by a lecturer providing elaboration of the points made), for follow-up review by an individual or small group of an instructional unit (particularly useful when professional activities, etc., interfere with one's training attendance schedule), and for independent study/learning. The modules are particularly effective when requiring the user's interaction ... with the actual module activities and/or with small groups of other learners. The modular units may also be accompanied by a variety of "touch-feel" materials, including extensive workbooks illustrated with line drawings to be colored (i.e., using map colors) by the users as well as activities that require tactile and kinesthetic experiences. The combination of a wide variety of sensory systems permits simultaneous as well as sequential access to ever widening neural pathways, hence, should enhance acquisition of content, retention, and recall.

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Distance Education for Educational Diagnosticians ... What we Learned about Synchronous Distance Education during the past 4 years

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Abstract: This paper includes a summary of what has been learned about synchronous distance education combined with multimedia modules during a four-year, federally funded project. The project, i.e., Project DEED – Distance Education for Educational Diagnosticians, provided specialty training to bilingual students in 8 different rural sites along the Texas-Mexico border corridor.

Introduction

Documented over-representation of minority pupils in special education classes has lead to advocating for special education programming that is sensitive to the needs of children who are culturally and linguistically diverse (e.g., Baca & Cervantes, 1997). Factors that have exacerbated this problem include bilingual/bicultural differences of Hispanic children from their mainstream cohorts (e.g., Cummins, 1984), lack of bilingual and/or Hispanic educational professionals (e.g., Brown & Minke, 1986), generally high attrition rates for minorities in undergraduate and graduate education programs (Howard, Pion, Gottfresson, Flattau, Oskamp, Pfafflin, Bray, & Burstein, 1986), and lack of adequate bilingual programming for handicapped Hispanic children (Baca & Cervantes, 1997).

The situation can only worsen as the population of minority pupils in our schools continues to increase and as significant shortages of qualified personnel in all areas of special education also continue. Indeed, the classification of "diagnostic staff" has continued to rank among the highest 5 areas of greatest need in the past few years (e.g., U.S. Department of Education, 1996; Texas Education Agency, 1999).

Texas, a state with a diverse population and economy is the second largest state in the U.S. and has the second largest Hispanic population (19%) in the nation. At its southern limit, Mexico borders nearly nine hundred miles. An area extending approximately 50 to 75 miles north of the border and along its length is referred to as the "border corridor," the area targeted for service within Project DEED, Distance Education for Educational Diagnosticians. According to the Texas Education Agency, enrollment in public schools totaled 3,748,167 students; 46.4% of whom were White (not of Hispanic origin), 36.7% were Hispanic, 14.3% were

African American, 2.3% were Asian, and 0.3% were Native American. Thus, minorities comprised 53.6% of the student population in Texas public schools with Hispanics as the largest minority group. Indeed, the state's youngest and largest population is Hispanic. Of the total number of students, 12.1% have been identified as eligible for one or more special education services, most of whom are included within the regular education program. Unfortunately, only 10.2% of the educational diagnosticians are Hispanic, many of whom are essentially monolingual in English.

Along the lower "Border Corridor," few institutions of higher education (IHE) are available to the majority of school personnel in this area, particularly practicing teachers interested in obtaining graduate training. In fact, most of the rural communities along the mid- to lower Border Corridor are from 60 to 140 miles distant from any IHE offering special education courses. As this point in time, only two universities, both located within the lower Rio Grande Valley area at the tip of Texas, provide educational diagnostician/special education training thus leaving several hundred miles along the border unserved.

Recent area needs assessments have indicated a significant and long-lasting need for bilingual special education teachers as well as educational diagnosticians. In addition, there is a strong need for in-service training of regular classroom teachers focusing on dealing with children with disabilities that are included in the regular classroom setting. The same needs assessments also reveal a heavy reliance on partially-trained individuals with temporary permits in critical special education areas, permits that often prove difficult to maintain due to the paucity of geographically available IHEs. Project DEED was originally designed to help offset this lack of training programs by extending our local educational diagnostician's training program to eight distal site bases. Multimedia modules were constructed with traditional local learning styles in mind to further enhance the effectiveness of the distance learning program.

Distance learning or education, alone, can no longer be considered truly "unique" as some form of delivering university-level courses, e.g., home study, correspondence study, independent study or external studies, have been in effect for almost 300 years (Spooner, Spooner, Algozzine & Jordan, 1998). Yet, electronic distance education remains an essentially untapped resource. Due to the competitive nature of IHE funding within the state of Texas combined with local budgetary limitations, funding for this project was obtained from the U.S. Department of Education's Office of Special Education Programs (OSEP). Essentially, the purpose of the project was to demonstrate the feasibility of using currently available, relatively inexpensive resources to develop quality educational offerings targeted to the learning styles of a specific population, i.e., bilingual, primarily Hispanic graduate students along the Texas-Mexico border corridor.

Project DEED, centered at the University of Texas at Brownsville & Texas Southmost College (UTB-TSC), involves internet-based videoconferencing in combination with computer-based, multimedia learning modules, supplemented by CD-ROM based independent study units, field supervised/individually mentored practica and two campus-based summer training institutes.

The intent of this paper is to share the experiences obtained as a result of the development and implementation of our project. We are currently in our fourth, final, year of funding. The course-based portion of the project will conclude with the completion of a final field-based practicum in the summer of 2002. Also in the summer of 2002, members of the cohort, i.e., consisting of 20 bilingual, certified and practicing teachers located in 8 distal sites, will be required to successfully complete both a written comprehensive master's examination and the state required ExCET examination to obtain their educational diagnostician certificates.

Development of an Idea

This project was feasible only because of the availability of T-1 fiber optic linkages that have been extended to all the Texas school systems in recent years as well as access to the internet. Further, availability of serviceable audio/visual conferencing systems, e.g., CUSeeMe (White Pine Software) and Microsoft NetMeeting, inexpensive videocameras, e.g., QuickCam VC (Logitech) and 3ComCameras, as well as user-friendly multimedia production utilities programs, e.g., QUEST (Allen Communications, 1995, now Mentergy, Inc.), made it feasible to offer a highly interactive instructional program.

Research on learning styles (e.g., Griggs & Dunn, 1995) supported the concept that the dominant Hispanic culture have learning preference patterns that are relatively unique to their traditional culture. This seemed to strongly suggest the need to address the differential patterns, e.g., including both face-to-face instructional approach (i.e., live videoconferencing as opposed to primarily text-based instruction typical of web-based courses) as well as interactive, visually stimulating materials (i.e., multimedia modules).

The QUEST utilities program was selected as it permits nonprogrammers to combine all available media (by way of preprogrammed instructions) with minimal "computer specialty skills" and produce stand-alone, interactive multimedia modular units. These modular units can be distributed directly via the internet (with participant/student responses recorded on the sender server) when constructed in HTML format, via a campus-based File Transfer Protocol (FTP) compatible server (thus permitting students to download modules directly to their own computers as do our cohort members), and, when confidentiality is required by high-security modules focusing on the contents and use of specific diagnostic tests, via CD-ROMs delivered by mail.

When the grant proposal was originally developed, the CUSeeMe freeware was the videoconference system of choice. Unfortunately, by the time funding was obtained, it had been commercialized as White Pine's ClassPoint/MeetingPoint videoconferencing system. As it was still the least expensive and most efficient system available (of the 16 other systems investigated), we remained with the selection, purchasing a 10 site, 2 instructor site "bundle."

What we've learned thus far.

Internet Videoconferencing

The use of videoconferencing permits real-time voice communication with acceptable, though slower, video. The effects of videoconferencing have, according to the cohort members, reduced the feelings of isolation and separateness from others in the project so often reported in the literature. Provision of the professor's interactive "telepresence" also seems to appeal to the traditional conceptualization of formal instruction and respect for authority associated with traditional Hispanic students. Being able to call students by name, equally directing questions to the entire cohort and providing positive feedback and encouragement have reduced the typical effects of distance learning, e.g., a tendency to be distracted from a "talking head" or passivity.

The videoconference system in use, i.e., CUSeeMe ClassPoint/MeetingPoint, was initially difficult to implement, even with the additional support service purchased. Part of the difficulty was that ClassPoint does not work well with NAT (Network Address Translation) or firewalls. Since our 8 different distal sites are served by several different commercial internet service providers, a variety of different approaches were taken to work around the NAT incompatibility. For the firewall problem, the computers at each of the different distal sites had to be issued static IP numbers and various switches and routers were reconfigured by the internet service providers to create portals in the different firewall programs; as a result, these specific computers are allowed to connect to our server only. This arrangement has restricted some of the instructional activities, e.g., we cannot visit other URLs during class for illustrative purposes as was intended. An additional difficulty experienced early in the program focused on the fact that available equipment as well as individual computer skill varied tremendously from site to site as well as among the cohort members. All too often the equipment at the distal sites are used by a variety of other individuals (e.g., faculty, staff and students); software is often added (which takes up excessive system resources causing CUSeeMe to crash) or deleted (requiring reinstallation before that site can join the next class) and, in one case, a camera was lost. Anyone wishing to replicate this approach would be well advised to consider using the same type of equipment, ideally dedicated to this project, throughout the sites as well as provide structured training on the use of equipment and videoconferencing software for students, faculty and staff prior to the initial class.

Internet reliability remains yet another limiting factor that continues to be addressed by the UTB/TSC campus Academic Computing staff as well as the regional internet service providers and the technology staff located at each of the remote sites. Unfortunately, this will probably continue in the foreseeable future in that

the internet's complexity continues to evolve. Then, too, there are the occasional 'glitches' due to unforeseen and unavoidable environmental factors such as when a hurricane took out one of our distal site's communication tower.

Once all the connections were finally established, however, CUSeeMe's ClassPoint/MeetingPoint software offered an excellent platform of services including ongoing chat room capabilities for those students preferring to respond in writing. One of the software's major strengths was that it permitted instructor control of the communicative give and take between the students as well as with their professor. It also allowed specific inter-site communication during the 10-minute discussion periods required throughout each three-hour class session. During these topical discussions, two or three differing sites would be connected so that they could both see and hear each other; all the other sites could either mute their own stations or, if they finished the assigned task early, could listen in to the ongoing discussion. To encourage freedom of discussion, the instructor usually turns his sound off while remaining available for response to queries submitted on the chat board. Common sense rules of etiquette did have to be established early in the program so that no one 'stepped on' another's communication. Although certain types of questions did require fuller treatment at a later time via follow-up email, brief manual communication, e.g., waves, thumbs up, etc., have successfully served most of the short communication needs.

Unfortunately, we have recently been informed that the CUSeeMe ClassPoint program has been "retired" as a result of a merger. ClassPoint users have been advised to migrate to CUSeeMe Web 2.0 and CUSeeMe Conference Server 5.0. This new software is Firewall-NAT compliant, so these connection problems should not occur in future.

Eight distal sites are currently in use, all but two of which contain a cohort of 2 to 3 individuals working collaboratively as teams, separate from yet an integral part of the whole cohort of 20 students. One site contains a single cohort member, another, 4 cohort members. While these group patterns have served well, future programs will require a minimum of two and maximum of three individuals at a single site. All of the cohort members have indicated small groups of socially compatible individuals are more conducive to learning. Any opportunities for the cohort members to physically work together, e.g., summer institutes, workshops or conference attendance, should also be encouraged as these activities have strengthened the cohesiveness of our overall cohort.

Multimedia modules

According to the cohort members, the multimedia nature of the QUEST-based programs fit the traditional Hispanic students' preference for structure as well as variety. While a wide variety of structures and appearances have been and continue to be employed depending on the module's content, student responses have dictated a merging of favored styles, backgrounds, and highlight colors into a narrower range. Essentially, light backgrounds with slight 'texture' are preferred to the dark gray initially in use; similarly, consistency in highlight colors has been encouraged (i.e., highly significant concepts and words are in dark blue and red, green and dark orange indicate secondary level significance, etc.). Content organization is encouraged with natural break points occurring on a 20-minute basis; modules that can be covered over a normal three-hour class period are preferred. As interactivity is built into the modules and combined with extensive workbooks and/or hands-on activities for each unit, the reported preference for kinesthetic instructional approaches has also been increasingly addressed.

In compliance with the grant funding, the multimedia instructional modules are being designed for both synchronous and asynchronous presentation. Synchronous delivery is made during a scheduled three-hour session held once each week of a regular semester, with the instructional unit running in parallel with videoconferencing. By adding the speaker's content in audio format while developing each instructional unit and providing a button to access the audio version, each module could also be available via asynchronous presentation for independent coverage and/or later review. Although voice-overlay may be formal, we are discovering that insertion of "captured lecture" (with the instructor covering each frame during an actual class period) has a particular appeal.

The primary problem with module development using the QUEST utilities software is that it is time-consuming. Although the utilities program is basically preprogrammed, the addition of detail such as 'drag-and-drop' activities, pop-ups, animations, and selecting choices, all needed for interactivity, require an extensive time commitment. As with most activities, the process does become easier and quicker with experience, particularly as one develops their own unique modular templates. While the modules produced are easily updated, they have to be re-released or issued following any changes made to the master copy. For a truly useful and interactive module, however, one does have to have a fundamental understanding and mastery of "C" language.

Need for Team Approach

A team approach, involving a majority of our campus technology staff working closely with the project staff and other support personnel is critical to any similar project. Assistance from individuals from several departments on campus, technology staff at each distal site, and those involved in the provision of internet services was required to develop the requisite connectivity among the various computers at their respective sites, installation of new specialty equipment on campus (e.g., expanded memory, RAM as well as hard drive capacity, scanners, video capture cards, etc.), installation of software, etc. Anticipated throughout the project is continued involvement of these specialists in an advisory capacity as troubleshooters whenever the need arises. The Academic Computing department at UTB-TSC has proven extremely supportive and vital in the initiation of this project.

Academic Results

At this point in time, the cohort members are in their final year and are completing their tenth course (out of the 12 required for their master's degree in special education (i.e., educational diagnostics). Four courses (three of which were non-special education classes) out of the 12 required were covered in two summer institutes; of the eight other special education course required, five have been completed online and a sixth course is currently underway. Two additional online classes will be offered as follows: one in the Spring, 2002, semester (focusing on achievement and ability test administration/scoring/interpretation), with a final six-credit-hour practicum scheduled for the first part of the 2002 summer; this course will involve shadowing local diagnosticians under their supervision as well as that of the primary author.

All of the cohort members continue to report the maintenance of high interest levels and, in spite of a variety of personal problems (including the recent death of a spouse), have all been able to complete their course requirements successfully. The grades earned have been predominantly "A"s. With but a single exception, there have been no more than 3 "B"s earned in any single course. Interestingly, the "B"s have usually not been made by the same individuals. The exception, i.e., where grades of "C" were earned by two individuals at separate sites, involved a detail-heavy course (focusing on the visual identification of over 55 syndromes and developmental disabilities) that was taken online over an abbreviated time period, i.e., 45 clock hours over a 10 week period rather than the usual 16 week period. Although this schedule was mutually designed by students and faculty to accommodate a specific situation, it was the consensus of all that more time between was needed to learn the requisite information, particularly since each cohort member was responsible for a full time teaching load. In spite of last Spring's setback, group morale continues to be high and the interactions among the cohorts, within as well as between sites, have continued to be positive.

Conclusion

In spite of the various difficulties thus far encountered, the project has been able to meet its predicted deadlines. Site connectivity has been established to the point that few disruptions in instructional delivery occur. Those that do occur tend to involve hardware problems somewhere along the 'internet highway' or at the individual distal sites. The cohort members, previously with little or no technology skill, have become skilled troubleshooters with the issuance of a "checklist" designed and disseminated by the Project Coordinator. Of course, there is nothing we can do to forestall the occasional hardware problem, e.g. cutting a fiber cable in the state capital, the effects of hurricanes, etc., so we still have the occasional non-connects. To accommodate

same, we continue to make a conference phone connection available. Too, the availability of the multimedia modules to supplement required text reading usually cover content lost due to the occasional inability to connect via the Internet.

In addition to the basic, anticipated accomplishments of the program, three cohort members who are also certified counselors as a result of their involvement in this project have experienced unexpected gains. Specifically, all three have completed the requirements for and have received certification as Special Education Counselors. Several additional cohort members have added the generic special education teacher certification to their personal certification inventories. Still others have been reclassified from classroom instructors to "diagnostic teaching" staff, i.e., they are working in close support with their respective campus diagnosticians, administering achievement tests, scheduling IEP meetings (called ARDs or Admission, Review and Dismissal Committees in the state of Texas), and providing other types of professional assistance.

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Knowledge Domains: A Global Structuring Mechanism for Learning Resources in WBT Systems

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Abstract: All the data structures previously introduced by different WBT systems were "training oriented" so to speak. Learners can perceive those data structures as different training paradigms reflecting mainly different ways of accessing and working through a subset of learning material. Primitively, a "training oriented" data structure mainly prescribes reading the document "A" before the document "B" and does not reflect a possible situation that "A" may be the documentation of the software module developed in the scope of a software project "B". Nevertheless, users often need a general overview and access to all learning resources provided by a particular WBT system regardless on any training data structure where those learning resources are reused within. The WBT-Master, a novel WBT system, supports such global structure of learning resources in the form of so-called Knowledge Domains.

1. Introduction

From the functional point of view, the term "WBT" refers to systems (Andrews et al., 1995) (Helic et al., 2000) that support at least:

- Authoring and publishing of high quality multi-media courseware
- Repository of learning resources available world-wide and anytime by means of WWW (Berners-Lee et al., 1994)
- Repository containing personal info on peer helpers, on-the-fly contributions of previous users, discussions on interesting topics, etc.
- Support for personal definition of learning goals and variety of learning methods
- Synchronous and asynchronous communication and collaboration among learners and between learners and expert
- Database of previously answered questions to automatically answer similar ones
- Testing of knowledge level
- Customization of courseware to the knowledge level and the cognitive style of the learner
- IPR protection and brokerage of relevant learning services
- Progress tracking and certification as support for assessment and recognition aspects of the acquired skills.

Technically, a WBT system is a system that utilizes a large repository of multi-media (preferably HTML) documents, where information is structured according to a particular hypermedia data model (Cailliau, 1995) (Fernandez et al., 1997) (Helic et al., 2000). The first WBT systems structured information according to the most simple node-link data model utilized by the WWW. Recently, new WBT systems were introduced utilizing more powerful data modeling facilities in order to overcome well-known problems of the basic node-

link data model (Maurer et al., 1996). WBT-Master (Helic et al., 2000) is one of those systems. The WBT-Master utilizes the unified HM-Data Model (Helic et al., 1999) and data structures supported by this model. This model supports data structures, such as Learning Unit, Learning Course, Learning Goal, Discussion Forum (Helic et al., 2000), etc. Such data structures are well-defined chunks of hypermedia information that may be reused in different contexts. Moreover, they provide the satisfactory authoring interface and impose a convenient navigational structure on the top of hypermedia information encapsulated in it. All other information services in WBT systems such as information searching, synchronous and asynchronous communication, collaboration, etc. are implemented as "add on" software packages using often different protocols (Server Site Scripts, Client Site Scripts, Java Applets and Applications, etc) (Helic et al., 2000).

From the user point of view, a WBT system is a system, which supports different user roles according to basic functionality, which is required. Most common definition of user roles in WBT systems my be seen as follows (Helic et al., 2000):

- Learners utilize WBT information services in order to improve their knowledge and skills. They are motivated to use the system services by a particular Learning Goal in mind. In a simplest case, the Learning Goal may be just a wish to pass an examination and to get some credits.
- Tutors manage the learning process on some particular subject. Tutors select an appropriate learning strategy (say, Learning By-Doing, Situation-Oriented Learning, etc) to achieve better learning results. Tutor control learners' progress with the material, offer additional materials and point learners to fellow helpers if necessary, examine learners' knowledge and acquired skills, etc.
- Authors contribute to courseware repository creating and publishing documents, combining the documents into navigable structures (courseware libraries, courses, learning modules, etc.).

Thus, one of the basic scenarios in WBT systems can be seen as follows:

- Imposing different types of data structures on top of existing collections of Learning Resources, which is done by authors, or looking from the other point of view, as reusing of Learning Resources in different contexts
- Customizing of Learning Resources by tutors to support reuse of Learning Resources in different contexts, as well as to adjust Learning Resources to different learners' preferences and needs
- Working through Learning Resources to achieve a particular Learning Goal, which is done by learners.

However, all the previously discussed data structures were "training oriented" so to speak. Thus, the previously mentioned Learning Unit, Learning Course, Learning Goal, Knowledge Card, etc., can be perceived as different training paradigms reflecting mainly different ways of accessing and working through a subset of learning material by learners. Primitively speaking, a "training oriented" data structure consisting of documents "B" and "C" mainly prescribes reading "B" before reading "C" and has nothing to do with a possible situation that "C" may be documentation on a software module implemented by the programmer "A" for a project "B". Often, users need a general overview and access to all learning resources provided by a particular server.

Let us just discuss the following situation. Suppose a software organization maintains a big repository of software technical documents. Obviously, elements of the repository are valuable Learning Resources and may be reused for training as such or as components of other Learning Resources (say, as members of Learning Units, resources for Learning Goals, contribution to discussion forums, etc.). Moreover, information on people maintaining documents and source codes is also a very valuable Learning Resource that can be reused as references to peer helpers having experience in the subject area. At the same time, localization of a particular Learning Resource (providing it was not previously reused for training) constitutes a rather difficult problem which can be solved only by structuring the repository on meta-level invariantly to any training paradigm. Using the same primitive language as above, we can say that the knowledge: "C" is a technical description of the software module implemented by the programmer "A" for the project "B"; should be kept independently of reusing "C", "B" and "A" for training purposes.

The WBT-Master supports such global structure of learning resources in the form of so-called Knowledge Domains. The rest of this paper describes the main ideas behind the concept of Knowledge Domains, as well as some of the implementation issues.

2. Knowledge Domains

Generally, a knowledge domain is a special hypermedia-structuring paradigm that is based on the concept of separating structure and content.

Each Knowledge Domain is a set of documents belonging to a number of predefined semantic categories. For the previously discussed example, we could speak about three semantic categories: "Author",

"Module" and "Project". We can also say that a document "C" is an instance of the category "Module", document "B" is an instance of the category "Project" and the document "A" is an instance of the category "Author". Speaking in general terms, we can say that each semantic category is linked to a set of learning resources that are called instances of the category.

Further, each Knowledge Domain explicitly defines a number of so-called semantic relationships between the semantic categories contained in this Knowledge Domain. Again, for the previously discussed example we could speak about the following semantic relationships: "Author Modules" is a relationship between the "Author" and "Modules" semantic categories, which denotes that a particular "Author" implemented corresponding "Modules"; "Project Modules" relationship relating the "Project" and the "Module" semantic categories and denoting that a particular "Module" is a part of a certain "Project". Applying the concept of semantic relationships to instances of semantic categories means interrelating these instances according to relationships between their corresponding categories. Now, we may say that the document "C" is related to the document "A" by means of the "Author Modules" semantic relationship. Similarly, the document "C" is related to the document "B" by the means of the "Project Modules" semantic relationship.

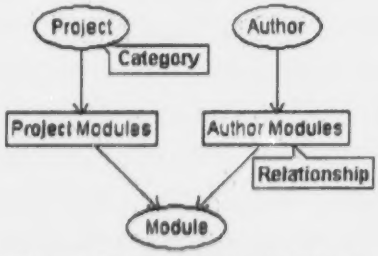

Figure 1: Knowledge Domain Schema

Thus, each particular knowledge domain is a collection of WBT-Master training resources (documents, learning units, individual users, etc.) that are structured using a predefined template called the knowledge domain schema.

A knowledge domain schema may be seen as a definition of all categories and all possible semantic relationships between them.

Learners may browse and search Learning Resources, reused and interrelated with other Learning Resources, as instances of semantic categories.

Thus, we may see that the concept of Knowledge Domain supports three different aspects of working with systems:

- Defining a Knowledge Domain Schema, which includes defining a number of semantic categories and a number of semantic relationships between the previously defined semantic categories
- Reusing resources as instances of different semantic categories and interrelating them with other learning resources according to a previously defined Knowledge Domain Schema
- Browsing and searching of learning resources reused as instances of previously defined semantic categories.

3. Defining a Knowledge Domain Schema

A Knowledge Domain Schema defines a data structure in the form of so-called semantic categories and semantic relationships between these categories. Any training resource added to the knowledge domain is perceived as an instance of one particular category and, thus, inherits all properties defined for the category.

The schema provides a number of attributes (data items) which should be provided for any instance of a particular category and types of relationships which should be installed between the new instance and existing instances of other categories.

Definition of a Semantic Category includes definition of a number of attributes, which are properties of instances of the Semantic Category. An attribute is a standard key-value pair. A value of an attribute is defined to be of a specified type, i.e., a value may be a string, a number or a selection from a list of possible values. For example, the "Author" may have just one associated attribute: Nam e (String). Similarly, the category "Module" may have two associated attributes - Programming Language (selection from a list of languages) and Name

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(String). Looking from another point of view, we can say that each instance of the category "Author" is provided with attribute "Name".

Definition of a Semantic Relationships includes the selection of two categories that participate in the relationship. Each semantic relationship defines 1:n relationship between instances of two different categories. A category participating with a single instance in each relationship is called "Owner" of the relationship. A category participating with multiple instances in each relationship is called "Member" of the relationship. Each instance of a Member is obligatory related to a certain instance of Owner; this reference is installed whenever a new Member is created. For instance, in the example above, the relationship "Project Modules" may relate a single instance of "Project" to an arbitrary number of "Modules", or looking from another perspective, each instance of "Module" is obligatory related to a certain "Project". This relationship will be created whenever a new "Module" instance is put into the Knowledge Domain. Similarly, the relationship "Author Modules" relates a single instance of "Author" with an arbitrary number of instances of "Module".

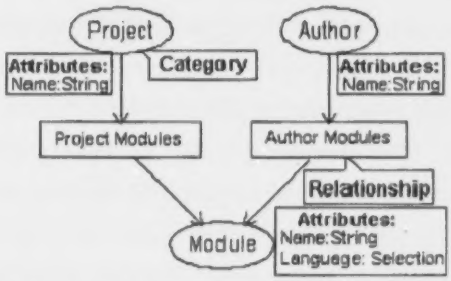

Figure 2: Categories and Relationships in a Knowledge Domain Schema

Existing of knowledge domain schema facilitates two rather important processes: structuring of a knowledge domain and browsing a knowledge domain. Whenever a new instance of a category is created, the system may assist the user with offering special forms for providing attribute values and for selecting other instances to be related to the new one. The system may also check whether all necessary information is provided and prompt the user if necessary.

From the browsing point of view, existence of a domain schema provides very useful information on a current document position within the knowledge domain and on semantic of links emanating from or pointing to the document.

4. Instancing Semantic Categories

The knowledge domain schema defines common properties of all the category instances. Any resource may be inserted (stored) into a particular knowledge domain as an instance of predefined category. Thus, a responsible author simply selects an existing knowledge domain and a predefined category for a new resource and the system guides the author through the process of defining attributes and necessary relationships. For example, if a new instance of the category "Module" is created, the system automatically request to select a programming language (attribute predefined for the category), and to provide references to the module author and a certain project (relationships predefined for the category). This, of course, facilitates creating of well-structured repositories.

5. Browsing Instances of Semantic Categories

The concept of well-structured Knowledge Domains facilitates also browsing and searching the resources reused as instances of semantic categories. Thus, for example, whenever a user access the document "Module 01/01", the system automatically provides:

- Information on attributes attached to this document,
- References to instances of other semantic categories which are related to this one,
- Next/prior navigational tools, etc.

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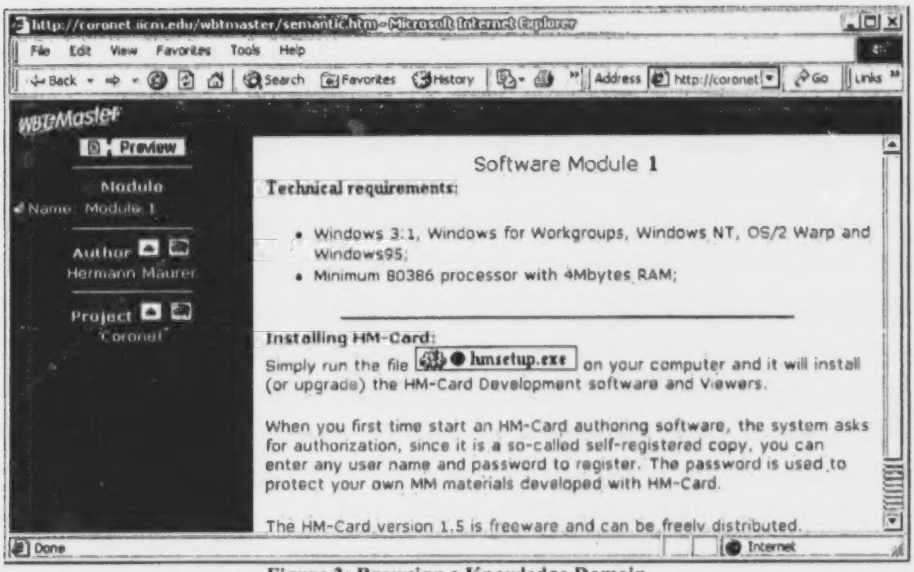
http://coronet.iicm.edu/wbtmaster/semantic.htm - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History Address http://coronet Go Links
WBTMaster
Preview
Module
Name: Module 1
Author
Hermann Maurer
Project
Coronet
Software Module 1
Technical requirements:
• Windows 3:1, Windows for Workgroups, Windows NT, OS/2 Warp and Windows95;
• Minimum 80386 processor with 4Mbytes RAM;
Installing HM-Card:
Simply run the file hmsetup.exe on your computer and it will install (or upgrade) the HM-Card Development software and Viewers.
When you first time start an HM-Card authoring software, the system asks for authorization, since it is a so-called self-registered copy, you can enter any user name and password to register. The password is used to protect your own MM materials developed with HM-Card.
The HM-Card version 1.5 is freeware and can be freely distributed.
Done
Internet

Figure 3: Browsing a Knowledge Domain

Thus, browsing a knowledge domain does not require any additional knowledge besides understanding of the predefined structure of the domain. Users simply select a particular knowledge domain and a certain category and all existing instances are displayed by the system. Selecting a particular instance results in the start of the actual browsing of the knowledge domain.

6. Conclusion

The concept of the Knowledge Domains facilitates many important features such as:

- Separating of the structure and the content of the resulting hypermedia database - as shown many times before (Helic et al., 1999) (Helic et al., 1999a) (Maurer et al., 1996), the crucial point for the successful maintaining of large WWW based hypermedia databases.
- Defining of new data structuring facilities through the concept of the Knowledge Domain Schema - provides a possibility to reuse learning resources in different well-defined contexts, thus, allowing learners to have new views on the learning material collected in a WBT system.
- The concept of the Knowledge Domain Schema provides means for template-based authoring - through the template-based authoring the authoring process is considerably simplified. A wizard-like authoring system is imaginable, as it is already implemented in the WBT-Master system. Such authoring system is easy to use, and a rapid production of learning material is easy to achieve.
- The result of the authoring process is a well-structured repository of learning resources - the concept of the Knowledge Domain Schema defines a database schema that is applied by authors in the authoring process to structure learning resources. Thus, the result of this authoring process is a very well structured database created in the accordance to a number of predefined database schemes.
- Searching in the system on a meta-level - attributes attached to learning resources, as defined by the Knowledge Domain Schema, may be comprised as the data on about the data, i.e., the meta-data. Such meta-data may be used to enhance searching facilities provided by the system, especially when they are predefined, as it is the case with the Knowledge Domains.
- Browsing learning resources on a meta-level - browsing of Knowledge Domains facilitates browsing of the concepts (comprised in semantic categories) and relationships between these concepts (comprised in semantic relationships between different categories) as opposed to browsing of individual documents or learning resources. Furthermore, when browsing instances of semantic categories those instances are provided with very useful additional information contained in attribute values attached to those instances.

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However, we believe that the concept of Knowledge Domains, as it is implemented in the WBT-Master, requires a number of improvements. Those improvements are mainly concerned with the concept of semantic relationships:

- It should be possible to define not only relationships of 1:n character but also relationships of m:n character; often the 1:n relationships are not sufficient to describe real-life relationships between two concepts. For instance, an instance of the category "Module" (i.e., a software module) may be a part of not just one "Project", but possible two or more "Projects". This facilitates the description of the concept of reuse of software modules, which is one of the basic concepts in the software engineering field.
- It should be possible to define not only binary relationships, but also relationships of an arbitrary arity. Usually, to describe relationships between different concepts, we need to apply n-ary relations between those concepts. For instance, if we say that the category "Module" has an attribute "Name" of the type String, we may comprehend this fact as a relationship between concepts "Module" and "Name". If we now consider other relationships of the "Module" category (e.g., "Project Modules") we end up with the category "Module" that constitutes a 3-ary relationships between categories "Name", "Module" and "Project". However, this facility should be explicitly supported by the system in order to improve the expressive power of the Knowledge Domain concept.

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Mentoring Sessions: Increasing the Influence of Tutors on the Learning Process in WBT Systems

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Abstract: The basic functionality offered by WBT systems is provided through a number of tools that support different user roles in those systems: authors, tutors and learners. Usually, learners utilize WBT learners' tools in order to improve their knowledge and skills. Authors contribute to the courseware repository creati ng and publishing learning modules. Tutors manage the learning process on some particular subject trying to bridge the gap between the courseware and learners. Usually, the success of a particular WBT application depends on the general quality of the cours eware offered by the WBT system, i.e., the success in WBT systems depends, mainly, on authors who provide the courseware. However, we believe that tutors' role, and not the authors' role, in WBT systems should become of the primary importance. It should be possible to exploit the enormous knowledge and experience that tutors posses by providing tutors with the means of more useful and powerful tools. The concept of Mentoring Sessions implemented in a novel WBT system WBTMaster provides a simple tutors' tool that improves the tutors' influence on the learning process tremendously.

1. Introduction

The enormous educational capabilities offered by the Internet, in general, and the World Wide Web (Berners-Lee et al., 1994), in particular, are very well recogn ized by the Internet community. In the past few years this recognition has lead to the development of a wide range of so-called Web Based Training (WBT) applications. The first developed WBT applications exploited the WWW as a perfect courseware dissemination channel to deliver the courseware to their users "anytime and anywhere". However, modern WBT systems are much more than just a simple courseware dissemination channel. Those modern WBT systems support much broader functionality providing facilities such as (Helic et al., 2000) (Andrews et al., 1996): support for different user roles (authors, learners, tutors); authoring of highly qualitative multi-media courseware; maintaining of large structured repositories of learning resources; customization of courseware to each particular learner; synchronous and asynchronous communication between different learners, as well as between learners and tutors; progress tracking, etc.

As already mentioned, one of the main concepts behind the modern WBT systems is a distinction between different user roles in the system. Thus, a standard WBT system distinguishes between the following three user roles (Helic et al., 2000):

- Learners utilize WBT information services in order to improve their knowledge and skills. They are motivated to use the system services by a particular Learning Goal in mind. In a simplest case, the Learning Goal may be just a wish to pass an examination and to get some credits.
- Tutors manage the learning process on some particular subject. Tutors select an appropriate learning strategy (say, Learning By-Doing, Situation-Oriented Learning, etc) to achieve better learning results.

Tutor control learners' progress with the material, offer additional materials and point learners to fellow helpers if necessary, examine learners' knowledge and acquired skills, etc.

- Authors contribute to courseware repository creating and publishing documents, combining the documents into navigable structures (courseware libraries, courses, learning modules, etc.).

Thus, all the previously mentioned facilities, supported by a WBT system, may be seen as different tools provided by such a system in order to support a particular user role. For instance, an HTML editor, that allows users to create highly interactive multi-media HTML documents that in turn may be interrelated into a navigable structure may be seen as a typical authoring tool in the scope of a WBT system. On the other hand, a chat tool that allows different learners to synchronously communicate with each other in order to discuss issues related to a particular courseware unit would be a typical learner tool supported by a WBT system.

The largest effort that many researchers and developers of WBT systems put in their work in the past few years, was directed toward improvements of authors' and learners' tool. Thus, all the modern WBT systems provide nowadays very powerful facilities that support authoring, structuring, providing a convenient navigational paradigms or publishing of highly qualitative multi-media courseware (e.g., Course Wizard in GENTLE (Dietinger and Maurer, 1997) (Dietinger and Maurer, 1998) or Course Scheduler in Lotus Learning Space). Further, facilities supporting learning process for learners such as: study rooms, annotations to learning material, synchronous and asynchronous communication with other learners and with tutors, course overviews, progress tracking and similar are nowadays a standard part of each WBT system.

A certain lack of good tutors' tools may be noticed in all the relevant WBT systems nowadays. Usually, tutors have just the following possibilities to influence the learning process in a typical WBT system:

- To customize the courseware prepared by authors by means of different authoring tools to the requirements and/or needs of a particular learners' group
- To communicate, synchronously and/or asynchronously, with learners, usually to answer questions related to a particular courseware unit
- To annotate particular parts of learning material that are important in the learning process
- To track the progress of a particular learner and to try to adjust, usually by means of tutors' tools already mentioned, the courseware and the learning process to a particular learner.

Even though tutors' role in a WBT system may be seen as a role of users who try to bridge the gap between the courseware on the one side and the learners on the other side (i.e., between authors and learners) they were not provided with tools powerful enough to achieve their goals. Normally, a success of a particular WBT application was based on the quality of the courseware provided by authors and the capabilities of different learners to comprehend the presented material. However, we believe that tutors should be provided with tools that will improve the significance of their role in a WBT system tremendously, even to make the tutors' role to be of the primary importance. In this way, a WBT application provided with good tutors could be a success, even if the quality of the courseware is not so high.

The WBT-Master (Helic et al., 2000), a novel WBT system, provides tutors' with much more powerful tools than it is the case with the most of today's WBT systems. For example, tutors may influence the learning process on the full extent through the concept of Learning Goals (Helic et al., 2000), or they may even author their own courseware on the fly through the concepts of unified HM-Data Model (Helic et al., 1999) (Helic et al., 1999a). In this paper we present a novel concept of so-called Mentoring Sessions, which is another useful tutors' tool supporting "live" mentoring of learners as they are working through a particular courseware unit.

2. Mentoring Session

The main idea behind the concept of so-called Mentoring Sessions tries to improve the significance of tutors' role in WBT systems. Beside authors, who prepare courseware for learners, and who are usually experts in a particular field, tutors usually have a large knowledge on a particular topic, as well as a considerable experience in working with learners. Tutors' tools in WBT systems should be designed in such a way that it is possible to take advantage over the knowledge and especially over the experience that tutors posses. In this way tutors could fulfill their main goal in WBT systems, and to do so at the full extent, namely, they could gap the bridge between the courseware prepared by authors for learners on the one side and the learners their self on the other side.

Thus, Mentoring Session is a tutors' tool that may be seen as:

- a special way of synchronous communication (online mentoring sessions) between tutors and learners
- a special method of structuring and presenting to learners existing learning resources (recorded mentoring sessions).

An online mentoring session is carried out as a data exchange between a mentor's client (so-called leading client) and a number of learners' clients (so-called led clients). Usually, a tutor operates the mentor's client, whilst learners operate their own client.

A recorded mentoring session is prepared by means of a mentor's client and can be viewed anytime by means of a learner's client.

The main idea is that the leading client is provided with a number of special tools to control the data displayed by the led clients to learners.

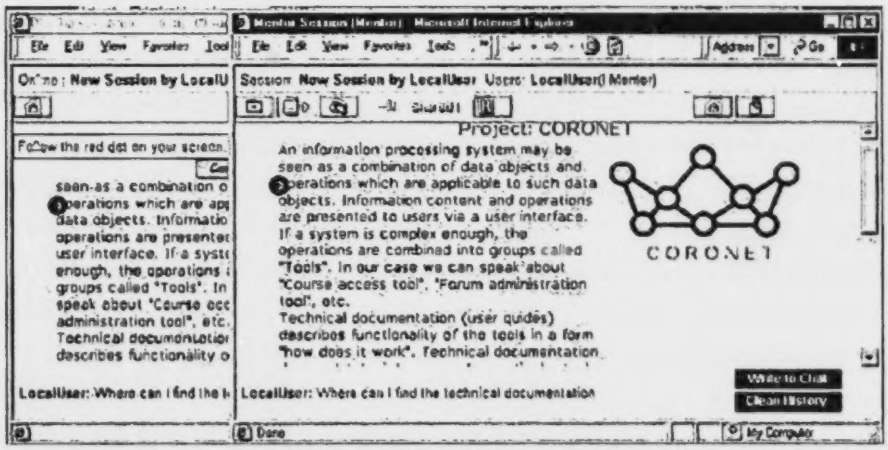
Project: CORONET
CORONET
An information processing system may be seen as a combination of data objects and operations which are applicable to such data objects. Information content and operations are presented to users via a user interface. If a system is complex enough, the operations are combined into groups called "Tools". In our case we can speak about "Course access tool", "Forum administration tool", etc.
Technical documentation (user guides) describes functionality of the tools in a form "how does it work". Technical documentation
LocalUser: Where can I find the technical documentation
Clean History
Done

Figure 1: Running a Mentoring Session

Thus, a mentor initiates a mentoring session and defines restrictions for learners to join the session. Selected learners are automatically notified about the session and can join it (i.e., can activate their led clients). The mentor is informed about learners joining the session.

The mentor selects and browses learning resources by means of the leading client. The leading client may be seen as a monitor controlling other tutors' tools and sharing the resource with led clients. The leading client simply passes the selected resource to led screens.

Additionally, the mentor can provide an explanation (text, voice and/or live pointer) attached to such shared resource. The explanations can take the form of a chat session or a special transparent layer on the leading screen where a pointer and texts may be put on the top of a current picture. The explanatory layer is also automatically displayed on led screens.

The leading client allows also accepting data from led clients. Thus, the mentor can request learners to perform an action (say, to write a short article), and monitor the process from the leading client.

Learners are allowed to provide comments to a shared resource by means of special chat facilities. The same mechanism can be used to ask questions in the context of a shared resource.

3. WBT-Master Functionality: Mentoring Sessions

WBT-Master is a novel WBT system that tries to introduce new ideas and concepts that go far beyond a standard WBT system. The WBT-Master distinguishes strictly between four different user roles in a WBT system, namely learners, authors, tutors and administrators. The leading idea in the WBT-Master development was that a WBT system should be just a set (possible large set) of tools, which support the main user roles in WBT system. However, one of the main directions of the WBT-Master research and development was a quantitative and a qualitative improvement of tools for tutors. It is because; we think that the role of a tutor is of the primary importance for a successful WBT system.

Thus, WBT-Master provides a number of so-called functional panels that encourage a usage of Mentoring Sessions. Those functional panels contain a number of activation buttons used to activate different tools, such as the leading or the led client in Mentoring Sessions. Thus, we distinguish the following three Mentoring Session functional panels:

- Session selection functional panel

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- Leading client (includes resource selection functional panel and resource control functional panel)
- Led client.

3.1 Session Selection Functional Panel

Mentoring Session Selection Panel is a list of all mentoring sessions (online and recorded) available on a particular WBT-Master server. A particular Mentoring Session may be selected from the list to work through it. Additionally, tutors may create a new Mentoring Session or edit an existing recorded Mentoring Session.

3.2 Leading Client

Usually, tutors use the leading client. The leading client provides:

- Information on the current session status: such information includes info on all learners working on the session and provides possibility to individually contact a particular learner by clicking on his/her name.
- Resource Selection Functional Panel; This panel provides a unified access to all training resources in a form of hierarchy of directories. In order to select a particular resource, tutors simply open a directory and click on a resource name. The resource is visualized in the working area and the leading client switches to the resource control mode.
- Resource Control Functional Panel: after a particular resource has been selected it is displayed in the working area and the tutor may work with the resource. Usually, the tutor may select to share resource with all led clients. After a resource has been shared the tutor may use pointer, write comments or install a web telephony connection, for example, with the led clients. Also, the tutor has to possibility to switch to the so-called "recording session mode" and provide learners with recorded Mentoring Sessions.

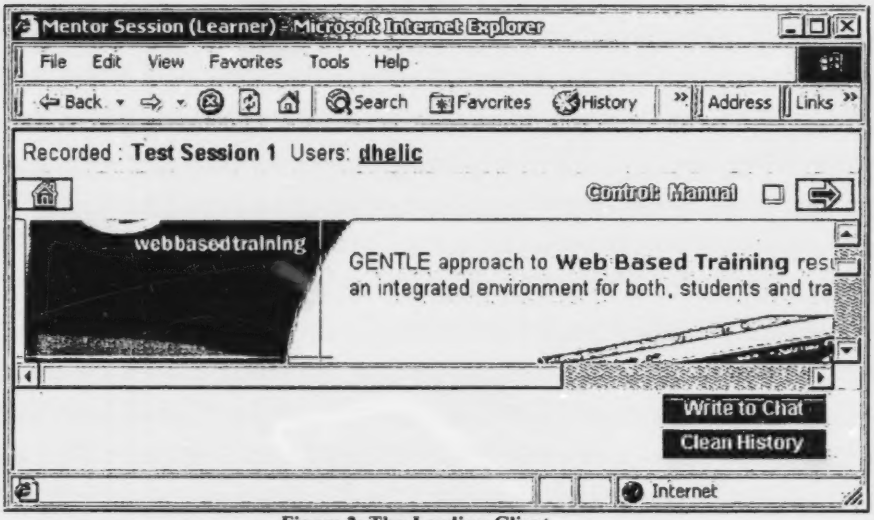
Mentor Session (Learner) - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History Address Links
Recorded : Test Session 1 Users: dhelic
Control Manual
webbasedtraining
GENTLE approach to Web Based Training
an integrated environment for both, students and tra
Write to Chat
Clean History
Internet

Figure 2: The Leading Client

3.3 Led Client

The led client just displays the shared documents, comments, pointer position and other explanations provided by the tutor leading the session.

Additionally, the embedded chat mechanism may be used to communicate with the mentor or other learners.

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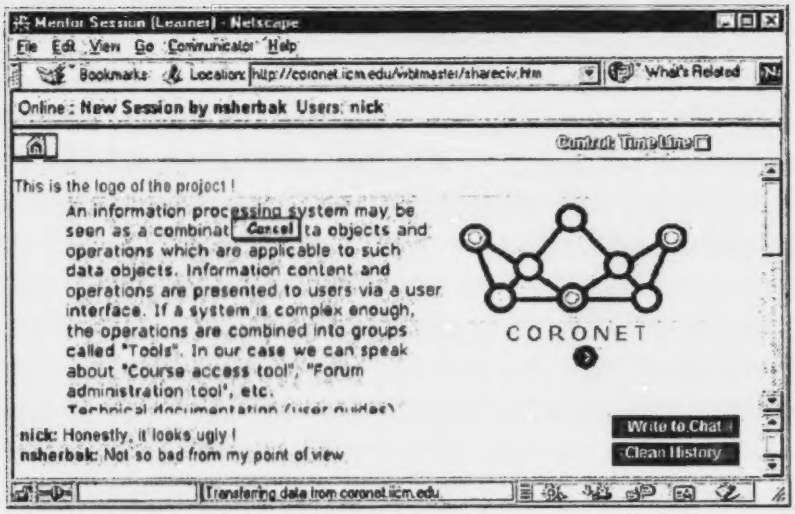
Mentor Session (Learner) - Netscape
File Edit View Go Communicator Help
Bookmarks Location: http://coronet.iicm.edu/wbtmaster/sharecw.htm
What's Related
Online : New Session by nsherbak Users: nick
Context Time Line
This is the logo of the project !
An information processing system may be seen as a combinat Cancel ta objects and operations which are applicable to such data objects. Information content and operations are presented to users via a user interface. If a system is complex enough, the operations are combined into groups called "Tools". In our case we can speak about "Course access tool", "Forum administration tool", etc.
Technical documentation (user guides)
CORONET
nick: Honestly, it looks ugly !
nsherbak: Not so bad from my point of view
Write to Chat
Clean History
Transferring data from coronet.iicm.edu

Figure 3: The Led Client

4. Conclusion

Through the concepts of Mentoring Sessions, Learning Actions and Learning Goals, as well as through the concept of authoring on-the-fly carried out by tutors and supported by the unified HM-Data Model, the data model utilized by the WBT-Master, the significance of the tutors' role and the influence of tutors on the authoring and learning process in the WBT-Master has been considerably improved. We believe that the tutors' role and their possible influence on all the aspects of a modern WBT system is of primary importance for a WBT system to become a success. Until now, the success of a WBT application was merely based on the possibility of authors involved with a WBT application to produce qualitative multi-media courseware and the ability of learners involved in the learning process to comprehend the presented material improving in that way their knowledge level. However, through the above-mentioned concepts supported in the WBT-Master, tutors may easily gap the bridge between the courseware and its audience. Tutors are now provided with facilities to put a crucial influence to the both: the authoring as well as the learning process, leading WBT systems to achieving their basic goal, i.e., acquiring the needed knowledge by learners.

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Inquiry findings from the Society for Technology in Education

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Abstract: Preparing the pre-service teacher Professional organizations have been the main thrust of the initiative to better train teachers to infuse technology into the K-12 classroom. ISTE has proposed standards for teacher preparation in technology. The National Council for the Accreditation of Teacher Education (NCATE) has developed curriculum guidelines for preparing teachers in the areas of educational computing and related technologies. Learned societies, such as the National Council for the Social Studies (NCSS) and the National Council of Teachers of English (NCTE) direct that the use of technology be incorporated into the curriculum at all educational levels. Many of today's public school teachers do not consider themselves competent in the area of technology. The principal investigators provided technology instruction and, as partner site coordinators and instructors, modeled effective use of technology in block education professional preparation classes. As an outgrowth of this project, pre-service and teachers reported much growth as measured by the new ISTE Standards A pre-test and post test were administered documenting student growth as compared with the new ISTE Standards The ISTE survey follows. In almost all cases, pre-test responses varied between 0% and 50%. Post test responses were nearly 100% on each item.

Inquiry findings from the Society for Technology in Education

(National Educational Standards for Teachers – International Society for Technology in Education)
As an education student I currently have the following knowledge, skill or ability:

31.identify the benefits of technology to maximize student learning and facilitate higher order thinking PRE D/SD =23.5% A/SA =52.9%//// POST D/SD =0% A/SA =88.2%

32.differentiate between appropriate and inappropriate uses of technology for teaching and learning while using electronic resources to design and implement learning activities PRE D/SD =35.2% A/SA53% =//// POST D/SD =0% A/SA =100%

33.identify technology resources available in schools and analyze how accessibility to those resources affects planning for instruction PRE D/SD =41.1% A/SA47.1% =//// POST D/SD =0% A/SA =100%

34.identify, select, and use hardware and software technology resources specially designed for use by PK/12 students to meet specific teaching and learning PRE D/SD =47% A/SA =47.1//// POST D/SD =0% A/SA =100%

35.plan for the management of electronic instructional resources within

a lesson design by identifying potential problems and planning for PRE D/SD =76.5% A/SA =23.5%//// POST D/SD =0% A/SA =93.1%

36.identify specific technology applications and resources that maximize student learning, address learner needs, and affirm diversity PRE D/SD =58.8% A/SA =23.5%//// POST D/SD =0% A/SA =100%

37.design and teach technology-enriched learning activities that connect content standards with student technology standards and meet the diverse needs of students PRE D/SD = A/SA =//// POST D/SD = A/SA =

38.design and peer teach a lesson that meets content area standards and reflects the current best practices in teaching and learning with technology. PRE D/SD =58.8% A/SA =29.4% //// POST D/SD =6.3% A/SA =94.7%

39.plan and teach student-centered learning activities and lessons in which students apply technology tools and resources PRE D/SD =64.7% A/SA =23.5%//// POST D/SD =0% A/SA =100%

40.research and evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information resources to be used by students. PRE D/SD = A/SA =35.3%//// POST D/SD = A/SA =100%

41.discuss technology-based assessment and evaluation strategies PRE D/SD = 70.6% A/SA =29.4%//// POST D/SD =5.9% A/SA =94.1&

42.examine multiple strategies for evaluating technology-based student products and the processes used to create those products. PRE D/SD =83.3% A/SA =17.7%//// POST D/SD =5.9% A/SA =94.1&

43.examine technology tools used to collect, analyze, interpret, represent, and communicate student performance data. PRE D/SD =64.7% A/SA =35.3%//// POST D/SD =5.9% A/SA =94.1%

44.integrate technology-based assessment strategies and tools into plans for evaluating specific learning activities. PRE D/SD =68.8% A/SA =31.2&//// POST D/SD =5.9% A/SA =94.1%

45.develop a portfolio of technology-based products from course work, including the related assessment tools. PRE D/SD =87.4 A/SA =6.3%//// POST D/SD =11.8% A/SA =76.4%

46.identify and engage in technology-based opportunities for professional education and lifelong learning, including the use of distance education PRE D/SD =58.9% A/SA =35.2%//// POST D/SD =0% A/SA =100%

47.apply online and other technology resources to support problem solving and related decision making for maximizing student learning. PRE D/SD =47.0% A/SA =35.4%//// POST D/SD =0% A/SA =100%

48.participate in online professional collaborations with peers and experts PRE D/SD =41.2% A/SA =58.8%//// POST D/SD =0% A/SA =100%

49.use technology productivity tools to complete required professional tasks PRE A/SA = 41.2% D/SD = 58.8% //// POST D/SD =0% A/SA =100%

50.identify technology-related legal and ethical issues, including copyright, privacy, and security of technology systems, data, and information PRE D/SD = A/SA =//// POST D/SD = A/SA =

51.examine acceptable use policies for the use of technology in schools, including strategies for addressing threats to security of technology systems, data, and information. PRE D/SD =70.6% A/SA =23.5%//// POST D/SD =0% A/SA =94.1%

52.identify issues related to equitable access to technology in school, community, and home environments PRE D/SD =70.5% A/SA =17.7% //// POST D/SD =0% A/SA =88.2%

53.identify safety and health issues related to technology use in schools PRE D/SD =64.7% A/SA =29.4%//// POST D/SD =0% A/SA =94.1%

54.identify and use assistive technologies to meet the special physical needs of students. PRE D/SD =64.7% A/SA =17.7%//// POST D/SD =0% A/SA =94.1%

Diversity in Institutions of Higher Education: Technology Resources

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Abstract: The goal of this session is to provide both the novice and the digerati a systematic examination of the power and potential use of hypertext and hypermedia as Internet Resources for Multicultural instruction. The presenters will demonstrate the use of electronic Multicultural resources(both Power Point and the WWW to facilitate teaching / learning about Multicultural Issues in the pre-K through 12th grade classroom . Audience participation will be encouraged. The presenters will share their Diversity web site -- http://www.ed.wright.edu/CEHS/diversity/diversity.htm. that was designed for instructional use for pre-service and inservice teachers. This is a megasite for Diversity resources. The presenters and attendees will discuss WWW resources that may be used for Multicultural instruction. Questions will be encouraged from the audience. This session should particularly benefit those who are teaching Multicultural education, those curriculum designers who are including Multicultural education in the curriculum, those who are seeking ideas and resources for NCATE accreditation in the area of diversity

Diversity in Institutions of Higher Education: Technology Resources

The term multicultural education is understood in a number of ways by various authors, depending on their own personal perspective. James Banks, a seminal authority in multicultural education, consistently maintains that multicultural education in the United States began as a response to inequities in the areas of racism, sexism and socio-economic status. In 1981, Banks stated that multicultural education is "an educational reform movement that is concerned with increasing educational equity for a range of cultural and ethnic groups" (32).

A Multicultural Perspective for Educators

National and state education standards mandate the teaching of multicultural education at the post-secondary level. As a result, many colleges and universities require multicultural or diversity courses for all students. As those who prepare the citizens today for the world of tomorrow, it is of paramount importance that pre-service and in-service teachers receive instruction in multicultural education.

Educators are role models for their students, just as parents set an example for their children. If teachers accept students in their classroom who may have some characteristics different from their own, the students in their classrooms will be more likely to accept one another (Finegan, 1999). Gollnick and Chin (1994) in their textbook, *Multicultural Education in a Pluralistic Society*, state the often-quoted statistics that by the year 2000, one-third of the school population will be composed of students of color. The authors also reveal that nearly 25% of children in schools today are living below the established poverty level. As the nation increases in diversity, and international commerce becomes an everyday occurrence, citizens of the future will need to grow in their appreciation and understanding of others.

Electronic Multicultural Resources

Thousands of educational multicultural resources available on the internet for use with students of all ages. The authors have organized these invaluable resources into the following multicultural categories: age, belief, class, ethnicity, exceptionalities, gender, language, and sexual orientation. Websites have purposefully been selected to represent various points of view to assist the pre-service and in-service educator in the process of information gathering, introspection, and self-evaluation. Thus some of the World Wide Web (WWW) sites documented will be from an educational reform perspective or from other perspectives. An additional and primary goal of this section of the text is to assist educators in developing a multicultural perspective that can be shared with their students.

Many professional and popular journals site addresses for new web resources daily. Some very interesting web sites are available for educators and for students. In fact, it is becoming a common occurrence for students and teachers to be publishing articles and their own webpages in an electronic format(Helms, 1997). For example, at the authors' websites (http://www.ed.wright.edu/cfinegan.html) and (http://www.ed.wright.edu/~rhelms/home.html) may be found links to articles, journals, associations, syllabi and exemplars of student work as well as additional hyperlinks to general education and multicultural sites.

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Creating a Collaborative Web-based Environment Through the Inclusion of Metaphorically Enhanced Graphics

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The inclusion of metaphors within a World Wide Web-based environment offers the users the opportunity to not only obtain a visual understanding of the information being presented but also aids the users in developing a clearer understanding of the information and builds upon their previously conceptual framework of understanding. The importance of a Web-based collaborative educational learning venture is also enhanced. Creating a collaborative Web-based environment through the inclusion of metaphorically enhanced graphics can be a difficult venture. However, through the careful and appropriate choice of a metaphor, the inclusion of metaphorically enhanced graphics will further the collaborative, creative e-learning environment that all e-learning environments strive to develop.

Project WebOracle
Developing an advanced web server security assesment tool

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Abstract: In this article we present the first results of the WebOracle Project, which aim is to develop a new free and open source security assessment tool for web servers. After explaining why such a tool could be useful for improving the security of web servers, we describe its design philosophy and mention its main advantages in comparison with other security assessment tools. Finally, some improvements that are about to being implemented or will be implemented in a near future are discussed.

Introduction

A significant amount of the security incidents that are delaying the expansion of e-commerce are not a fault of the security protocols implemented, but of the lack of security in the machines involved in the transactions (mainly web, database and mail servers). There is a huge amount of web servers with a poor or null security level, which are supposed to carry out secure e-commerce transactions. The use of servers that implement high-end cryptographic solutions over a system with insufficient security is an anachronism. Unfortunately, this is a quite common situation that makes the modification of the contents of a web server or the theft of confidential data (two of the most popular attacks) relatively easy, even for newbies or script kiddies.

Why even critical web servers have, in many cases, a very poor security? There are lots of factors that explain this fact. First of all, there are not enough trained security administrators, because only large companies can afford them. Typically, security is a task accomplished by the classical system administrators that may, or may not, know much about security. In any case, they usually do not have much time to spend in learning or implementing security (usually the user that forgot his password or the printer that does not print has top priority). Web security is, also, relatively unknown to security novices. Menaces behind insecure CGI's, PHP scripts, Frontpage or Coldfusion extensions do not seem serious enough to many people, who consider them not a real threat. They even believe that a correctly configured firewall must protect their web servers from this kind of attacks or abuses. This bliss is a fatal mistake since both the search and the exploitation of vulnerabilities is done via port 80, so every firewall will allow it because it is considered ordinary http traffic between a client and a server. Finally, lack and relatively unpopularity of tools to assess the security of web servers make the discovery of weaknesses, and its fix, a little harder.

These were the foundations that prompt us to start the WebOracle Project to develop and offer a security tool that could help administrators.

Design Criteria

WebOracle is freeware. This is important because, although some well-known general security assessment tools also include web security modules, these tools are generally quite expensive and, for this reason, cannot help all the Internet community.

As expected in a project open to all the Internet community, WebOracle is open source to help others to understand how exactly it works and motivate them to cooperate with ideas, suggestions or even code to improve the tool. Open code is also a very important feature in security software, thus avoiding any suspicion of backdoors or malicious code. It is also interesting to have the source to know exactly how it works and being capable of quickly detecting possible bugs, failures or limitations.

As an example, we can cite a curious *technique* that some programmers used in the past: To verify if the answer from the web server was a *200 OK Found*, they simply checked the string returned by the server searching for a *200* sub-string. This quick, straightforward and simple technique seemed to work fine until the year 2000, when the tools that used this technique had to be changed to avoid the huge number of

false positives found because of the 2000 in the date the server returned. If this technique were applied in a non-open source tool, it would not have been so easy to detect and solve those problems.

Another good example of easier-but-not-better programming technique was used by the expensive and noted Internet Security Scanner. ISS, even when the excellent (but complex to implement) TCP/IP stack fingerprinting technique was available to determine the operating system of a remote machine, simply grabbed the easily modifiable banners of some services to do the same. In some cases, closed source code makes the use of inadequate or obsolete techniques easier.

So, apart from other advantages, security administrators must prefer open source tools for knowing which exact technique is used to do something, thus being able to completely understand the results.

WebOracle has also been developed trying to maintain as much code clarity and compactness as possible, to facilitate its understanding thus improving the learning curve by volunteers who want to collaborate in the Project.

WebOracle features

This first available version of WebOracle (v2.0) has a number of advantages, apart from being open source and free, over other similar tools. Here we will mention some of them.

1. It is an all-in-one tool for web server security. It offers all the functionality that can be expected in such kind of tools: In fact, it provides two features that no other web server security assessment tool offers simultaneously, namely security checks (named Check in the tool) and contents checks (named Explore in the tool). There are lots of security tools that can help in detecting insecure CGI's and similar dangerous scripts, but none of them are also capable of performing such a complete blind search for hidden contents in the web server. This is also an important security test, because many web developers provisionally leave contents into not directly accessible directories, these contents are usually private (use. files or databases) or even dangerous (source code of new scripts in testing phase that can help others to detect bugs and exploit them later). Anyway, they commonly put these contents into not directly accessible (not reachable by clicking in links of the normal web server contents) directories, and they rely on this doubtful mechanism to maintain these contents hidden. This is a serious and extended mistake that can be easily exploited, simply doing a recursive blind attack, which consists in asking directly for common directory and file names to the web server (i.e.: /data, /publisher, /test, /mail, /cards, /pub, /public, /applications, /application, /app, /scripts, /demo, /logs, /log, /login, /search, /.htaccess, etc... or even all random combinations of less than N characters) until obtaining a positive answer from the server, and then proceeding recursively, if necessary.
2. The security checking is fast and highly configurable. This possibility of configuring what is considered a hit, and what is not, is quite relevant. For example, in some cases a *403 Forbidden* answer must be considered a relevant result that could indicate the existence of vulnerable scripts that have a (possibly simple to bypass) IP access control, and in other cases this response must be discarded as non-relevant. Classical tools usually choose one of these three main possibilities:

    a) Consider that any answer different from a *200 OK* is equivalent to a *Not Found*
    b) Consider that any answer different from a *404 Not Found* is equivalent to a *200 OK Found*
    c) Print the server answer an let the user interpret its significance

Clearly, option a) produces too much false negatives, and option b) produces too much false positives, whether option c) is more accurate but lacks flexibility and can produce mistakes or omissions when the output is large and the number of answers of a given class is small. WebOracle provides better configuration capabilities because it offers a default hit/not hit configuration that can be directly changed by the user to any on the possible combinations, thus allowing an easy and agile adaptation to different needs.

3. Update feature: The file with the data contents (vulnerabilities to check and resources to explore) can be obtained directly from within the WebOracle tool, with no need of using any other http client, although this is also a possibility. It is quite obvious that this file must be continuously updated to reflect recently discovered vulnerabilities or new default directories that new versions of web server software or applications may include. This will be one of the paramount working areas of the Project.

4. Meaningful negative server answer: In many cases, the tools that automatically check for vulnerabilities simply ask the server for a given resource, let's say /cgi-bin/phf and return its answer. In this case, it is possible that a *404 Not Found* answer is due to the non-existence of the cgi-bin directory, which could have

been renamed to /cgibin. In most web security assessment tools, this would produce a *404 Not Found* and nothing else. WebOracle has a more advanced way of managing this situations: When it is asked to look for /cgi-bin/phf, WebOracle would understand that this request is an aggregation of a location plus a resource (location=/cgi-bin/; resource=phf). If not previously checked for the location, WebOracle will firstly request the location to the web server and then the location+resource. The result of this request will be much more revealing: If the location is not found, the answer for the request of the location+resource will be another 404 Not Found but will clearly point the user to the reason of this answer. This allows him/her to change its location and, possibly, find the same resource under a new path.

In addition with all these features now included in WebOracle v2.0, for different reasons, the development team decided not to implement some other features nowadays found in web security assessment tools. As an example, the possibility of using a proxy server (commonly used to maintain anonymity while exploring or attacking other's machines) was considered and rejected, as was the use of Intrusion Detection Systems (IDS) fooling techniques implemented, for example, in Whisker and Void-Eye. We feel that our tool must not implement any technique that could ease its criminal or illegal use. This was also the main, but not unique, reason for not implementing an interesting technique found in Whisker that limits the requests for certain vulnerabilities to certain web servers. When using this technique (we can call it *intelligent request method*), after performing a request to know which exact web server we are testing, the tool only searches for vulnerabilities known to be associated with this web server software. This is a very interesting technique, but was developed mainly to reduce the number of http requests needed to detect vulnerabilities, thus decreasing the odds of being discovered by an IDS. This technique has a very important drawback, that definitely prompt us not to implement it: It can be easily abused to fool the tool to conclude that a weak web server has not any vulnerabilities. Even if the web server is buggy, simply by changing the web server identification message (something that is very simple to do in many systems), the tool will only request vulnerabilities that will not be found, thus giving a false and dangerous good security diagnostic.

Project status

WebOracle is a Project open to all the Internet community which aim is to offer a free and open source tool to assess the security of web servers that is also advanced, secure, flexible and regularly updated. This tool has been developed after careful evaluation of the characteristics and features that such a tool must offer, and has been tested by many students, whose suggestions contributed to its improvement. It is compact, and its user interface and code is simple and easy to understand to motivate others to join the Project and help in improving it. WebOracle has been developed in Delphi and nowadays runs on any Windows platform.

In the near future, we expect that, with the help of Kylix, it can be ported to Linux platforms. The actual version of WebOracle, that is WebOracle v2.0, has recently been finished and will be soon available in a large number of websites all around the world. We are now working to obtain the resources needed to get an adequate domain, web server and web site for the Project.

Future work

In the near future, apart from the obvious tasks of updating the data files with new web server vulnerabilities and resources, there are some other interesting features that are about to be implemented and will be launched in the next version of WebOracle:

-An http link will be associated with every vulnerability: this will allow any user who finds vulnerabilities in a web server to click on the results frame of the application to get information about its severity and how to solve it. In later versions, the possibility of making an automatic report of the security of a web server will be implemented.

-Every vulnerability discovered will have an associated colour that will indicate its danger. In later versions, the possibility of making an automatic user-friendly report of the security of a web server will be implemented.

-Apart from the data file with commonly found vulnerabilities and directories + resources, there will also be a special feature that will allow the use of language-specific resources. The files with these language-specific contents will be automatically generated and will be found in the web site of the Project.

-The Update function will include an integrity check of the contents of the file downloaded to verify its correctness and the success of its transfer.

-The WebOracle tool will be offered in as many webs as possible to allow its wide use and receive more feedback form its users. It will be downloadable, in a near future, apart from its own web page, from the main security sites of the web (SecuriTeam, SecurityFocus, PacketStorm, etc)

Any other new feature that any of the users of WebOracle would suggest will be seriously taken into consideration.

Conclusions

Although WebOracle is a relatively new Project, it has started offering an interesting tool that can help thousands of security administrators world wide in assessing and improving the security of its web servers.

The rest of the project is supposed to be relatively easy and straightforward, as it mainly consists of updating the data file with new vulnerabilities and resources and slightly improving the tool with new features suggested by its users.

We will try to react as soon as possible to new vulnerabilities and new trends, to evolve this Project and tool accordingly to the evolution of the security field for always offering a state-of-the-art free, open source, professional, helpful and updated security tool.

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Search engines as a security threat

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Abstract

In this article the authors want to show that search engines are excellent tools for the hackers. This is mainly due to the extremely weak security policy they implement. For that reason, the services they provide can be abused to attack machines anonymously, search for easy victims, or gather confidential data.

1 Introduction

Search engines offer an increasing number of services, and index a really huge number of pages and other resources that sometimes, inadvertently, expose the security weaknesses of companies, and even their confidential data.

In this work we present a number of techniques to show that search engines can be used, or abused, by hackers to attack anonymously, find easy victims and gain relevant knowledge that, in some cases, can be more than enough to mount a powerful and promising attack.

Anonymity is one of the main objectives of hackers, mainly to elude legal consequences of their acts but sometimes simply to avoid being thrown out by their Internet Services Providers. Some search engines services *provide* this *service* for free, because they can be abused to act as anonymous proxies, thus hiding the identity of their malicious users.

Also, many people are not really aware of the security implications of the existence of weak machines connected to the Internet. Those machines could be used to compromise the security of any other Internet machine in a variety of ways. Sometimes these machines do not store any important data but are trusted by third party networks. Consequently, a hacker could easily get access to the vulnerable machine and, from it, hack an important trusted network. In this way the attacker could also obtain anonymity, after wiping any log files or tracks in the weak machine. Another way to exploit those weak machines is to launch distributed denial of service attacks (DDoS), making them work as *zombie machines*. Unfortunately, every Search engine can be used to find easy victims almost effortlessly.

For mitigating these threats, we also present a number of countermesures that, if implemented by the search engines, would make much more difficult the task of abusing vulnerable machines.

2 Search engines can be used as a nonymous proxies

Lots of search engines, including two of the most popular (Altavista and HotBot), offer automatic web translation to its users. The working of this service is simple: the user requests an URL to the search engine translation machines, and these download this resource locally, translate it, and finally send back the result to the user.

This procedure allows any user to effectively use the translation machines as proxies, which would be quite inoffensive if it were not for the fact that both Altavista and HotBot act as anonymous proxies. This allows any of their users to navigate anonymously, hiding its real IP address behind the translation machine IP's.

Chaining translation machines from different search engines is also feasible and extremely easy, making user's identification even harder.

Although anonymous surfing could not appear as a serious security risk, this anonymity may be used to avoid the legal effects that some simple http requests could have. For example, the http request http://www.some.web.server/msadc/Samples/SELECTOR/showcode.asp?source=/msadc/Samples/../../../../boot.ini would return the contents of the boot.ini file on some web servers running Internet Information Server (IIS) 3.0 and 4.0, so this feature of the main search engines can be abused to anonymously find and exploit vulnerabilities in web servers.

3 Search engines help to find easy victims

The huge number of pages indexed by the largest search engines (for example, Google announced 1,346,966,000 in June 2001) makes them excellent tools for identifying easy victims.

One extended and very simple technique is to search for recently installed or unattended web servers, because they will surely not have a very good security. This can be accomplished simply by searching for text strings, images or other contents that characterize default installations of certain web servers. For example, if the string *"Try the hyperlinks above to see some examples of the content you can publish with Microsoft Internet Information Server. To learn more about Microsoft products that you can use to create great-looking Web pages"* is found in a web server, there is a high probability that it is an out-of-the-box IIS installation.

Analogously, the string "*This page is used to test the proper operation of the Apache Web server after it has been installed. If you can read this page, it means that the Apache Web server installed at this site is working properly.*" characterizes a default Apache installation.

This method for finding unattended or recent installations gives to the hacker a large list of potential easy-to-abuse victims.

Hackers can also look for default pages that correspond to old (and known to be buggy) web server versions, simply by including the copyright year into the search string (as in '*©1997 Microsoft Corporation. All rights reserved*'). They can also look for web servers with a very poor security reputation, like the Personal Web Server from Microsoft (which has a possible search string of '*This home page is hosted on Microsoft Personal Web Server (PWS) 4.0. PWS turns any computer running Windows® 95 or Windows 98 into a Web server and enables instant publication of personal Web pages*"), or the Zeus Web Server.

Obviously, the searching method explained above can be slightly improved by expanding the search string and/or restricting the search to recently indexed web pages. Some other variations are also possible, but explaining how to get better results (or weaker victims) is beyond the scope of this work.

Alternatively, many of the main search engines have a feature that allows any user to search for multimedia contents as graphics, banners or logos, including image files (jpeg, gif, etc.) that are present on default pages. This can be used to locate default installations solely or in combination with the string searching technique seen before.

4 Finding confidential files and data

We have clearly shown that some search engines are a serious security menace for the rest of the Internet because of their indexing policy and lack of defence against malicious users. If conventional search engines have those problems, the case of FTP file search engines is even more dangerous.

FTP file search engines, notably Lycos FTP Search, have thousands of entries that point to weak machines, machines which leak confidential and/or critical data, all over the net.

In spite of being encrypted, it is obvious that no sensible administrator wants to see his machine's password files linked from a search engine so that everyone can find them. Well, for thousands of machines over the net, this is exactly the case.

Obviously, FTP file search engines are not the only responsible for this information disclosure, because it would have been impossible with a proper protection of the machines.

Let's see some cases:

When using Lycos FTP file search engine to find files so confidential as /etc/passwd and /etc/shadow we got hundreds of interesting results.

But not only common files such as /etc/passwd and /etc/shadow leak important information about machines. For example the .htaccess and .htpasswd files, used respectively to control the access to some contents within a web server and to store the passwords that authenticate this access, are also relevant and easy to find with the help of Lycos FTP file search.

In many cases, the exploitation of the information leaked by search engines is much simpler and quicker, as when a hacker finds files encrypted with a weak algorithm that allows him to instantly recover a password. Passwords are frequently reused, so this could ease significantly the guess of the root's password. A typical example could be the weak encryption algorithm used by CuteFTP to store passwords in the file *SMDATA.DAT*, or the Netscape Enterprise Server password disclosure that is related with a poor encryption of the file *admpw*. A search for files as *SMDATA.DAT* or *admpw* will allow an attacker to obtain crucial information in a very simple and straightforward way.

5 Looking for auditing results

For ending this exposition of the risks of search engines, we want to remark that they can also be used to find security audits and assessments of machines, which gives crucial information to a potential attacker.

An interesting example is a file (we will not give more details to ease its finding) that can be find after a simple search with Google. This file contains audits of more than 4900 web servers, all in the *.edu domain, most of which are shown to have a very bad security.

6 Some countermesures

Obviously, search engines should take some actions to avoid indexing confidential information. Apart from the fact that this helps attackers, under some laws can be considered as a crime. Anyway, nowadays they do nothing at all to avoid this information leaking, which is certainly not only a fault of the web bots policy but also of the administrators of these machines.

Fortunately, there are a number of easy-to-implement ideas that can solve, or at least, minimize this abuse of services and information leaking.

Here we mention some of them:

1) The solution in which the translation machines behave like proxies is the most natural and simple and would be adequate if it were not for the fact that they act as anonymous proxies. This anonymity feature is a problem that could be easily solved if the translation machines tell the server which is the real origin of the request. This can be accomplished, for example, by using the REMOTE_ADDR, the HTTP_X_FORWARDED_FOR or the HTTP_VIA headers. If this were implemented in all the search engines, potential intruders would immediately stop using then as anonymous proxies. If, on the other hand, this is never implemented, probably there will be a rise in the number of people that use this mechanism and more and more webmasters will forbidden access to their pages from the range of IP's where translation machines are. The case of Infoseek (also known as Go) is an uncommon example of good practices: although they provide translation services trough SystranSoft, their services can not be abused because they use the REMOTE_ADDR http header to inform to the

web server of who did the original http request. They also avoid to chain translation proxies by rejecting auto-translation request.

2) There is no reason at all for indexing the default web pages that web servers offer. This indexing is only useful when trying to find easy victims, so bots should be programmed to do not retrieve default web pages or/and the search engine to do not show this kind of results. Both bots and search engines can have an easier work if the developers of web servers would include a default restrictive robots.txt (not may administrators use them) or a special META TAG such as:

<meta name="function" content="Default Web Server Page">

3) There are lots of files of different security value that must not be retrieved by any file bot. In fact, these bots probably should follow a very simple security policy: only retrieve what belongs to the /pub directories of ftp servers, no more no less. Retrieving, even partially, the contents of the /etc directory could be enough under some laws to motivate legal prosecution. The obedience to a file similar to /robots.txt could also be very useful in the case of ftp bots, if the developers of ftp daemons would include one in their distributions. Unfortunately, this is not the case and it will take some time (and many security incidents) to take us there.

7 Conclusions

As we have said, this paper is an attempt for improving the Internet security. It is clear that this is not a trivial task and also that the problems described into the above sections are only a small set of them.

Search engines have became an interesting hacking tool and, like any other new and powerful hacking tool, the security community must be aware of its use.

Obviously, all responsibility must not fall on search engine's shoulders: they are obviously not responsible of the huge number of insecure machines all over the net. Anyway, we strongly believe they must take some actions immediately to avoid their services being used to find and abuse anonymously weak machines or confidential information.

Nowadays, search engines do not take this menace seriously into consideration. The authors believe that the present situation must be improved and strongly encourage search engines administrators to take the proposed countermeasures into account.

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Generation of Navigation Script from Log and Link

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Abstract: The World Wide Web (WWW) is a treasure of knowledge. To make good use of such web resources, we propose a method to generate a navigation script from a user's browsing log and the link structure between the pages. The system guesses the behavior of the user and generates a script. The script is described with sequential, selective and parallel controls.

Introduction

With explosive spread of the Internet, the World Wide Web (WWW) has become the most widespread electronic medium, and it's a treasure of knowledge for human beings. But it is not easy to have a good command of WWW, because each Web site is designed independently. We need some technique to search and make good use of the information on the WWW. Many people open their bookmarks to the public to share their knowledge of these resources. Many organizations are providing good lists of URLs. For example, U.S. Department of Education is systematically collecting hundreds of educational web resources supported by agencies across the U.S. Federal government at http://www.ed.gov/free/.

But, the larger the amount of information is, the harder we face when we browse Web pages one by one. To overcome the difficulty, we have developed Web Navigation System that guides viewers through the web resources in specified order and with the passage of time (S. Hirokawa et al. 2000). An organizer of a navigation course can determine how to make viewers follow a series of Web pages and how to make them choose from several courses.

In writing a navigation script, we have difficulties in

(1) collecting many materials,
(2) organizing materials in clusters,
(3) arranging them in a series, and
(4) making them for choice.

To solve (1), links and archives are effective. To solve (2), clustering or visualization of URLs is effective. But these solutions only provide static organizations of the material and cannot be used dynamically. There are some authoring tools such as Authorware (http://www.macromedia.com/jp/software/authorware/) for generating a web navigation. But only local materials can be used. The site of "tourum" (http://www.tourum.com/) supplies a web navigation. But the number of URLs is limited to 10 for one tour. In both systems, we need to generate a web tour by hand.

When we search for a web resource, we usually use search engines. We enquire a keyword to a search engine, and then get links to many pages. These pages contain information about the query that we asked, or they contain links to other pages related to the query. We would obtain a desired answer, some new keywords or links to follow. We repeat this process until we are satisfied. It differs from person to person what kind of the world he would obtain after these processes. We think that this is a process of Personal Information Organization on the WWW. In this paper, we propose a systematic method to generate a navigation script from such a process.

We generate a navigation script from a browsing log and link information. We can create a straight sequence of URLs applying a naive method for the browsing log. The method we propose in this paper guesses the behavior of a viewer of Web pages. Imagine that the viewer visited a page from which several pages are

linked. When these linked pages are listed on the log, we guess that he tried several choices among these links in the page. In such a situation, we form a navigation script with selective controls.

The relation of pages abstracted from the log is typically a directed graph. But it is not always the case that all of these pages are linked to each other. For example, when a user browsing a page recalls a new keyword, the pages obtained for the new keyword from a search engine may not connect to the pages he visited previously. We use the time stamps in the log to connect these separated directed graphs.

There are many efforts to refine site maps using log analysis (T. Joachims et al. 1997, M. Perkowitz et al. 2000). Our approach is different from them in a sense that the log we analyze in this paper is that of a client and is not that of a server of a site. There are researches of web tour systems (M. L. Huang et al. 1998, J. John et al. 1998). They are kinds of interactive authoring system. The method we propose is applicable independently from navigation system. All we need for generating a navigation script is simply to browse Web pages. There is no need for designers to generate navigation scripts since the method generates automatically from the log recorded while we are visiting interesting pages.

The rest of the paper is organized as follows. In Section 2, we explain our navigation system and the navigation scripts. In section 3, we describe the way to record a client's log via a proxy server. In section 4, we explain how we use log and link to generate a navigation script.

Navigation Script and Navigation System

In this section, we briefly describe our navigation system (S. Hirokawa et al. 2000). It organizes web resources into a web tour. The tour is described in a script which we call Navigation Script. We made an interpreter which controls the navigation of WWW automatically and interactively. The most important feature of the navigation system is to guide the user around web pages in specified order. So, we adapted sequential control to the navigation language. We can use multimedia data, e.g. audio, video, and images, together with html-files. Those multimedia data are played in parallel. To increase the variation of the navigation, we introduced selection mechanism. Thus, the language we made became a structured programming language with sequential, parallel and selective controls. The basic navigation unit is a multimedia data specified as URL. We designed the script language with XML. There are 6 kinds of elements as follows. All navigation courses can be expressed by combining these elements.

<statement>: This tag represents the root of navigation tour. It may contain sub-tours as children. There are four kinds of tours, simple, sequential, parallel and select.
<simple>: This is the basic unit of the navigation. It contains a message to represent a web page. It has the attributes of kind, target name, play time and delay time. Target name specifies the URL. Kind describes the kind of multimedia data. Play time is the duration time and delay time is the time to wait before play.
<sequential>: It may contain sub-tours of simple, sequential , parallel and select. Sub-tours are followed consecutively.
<parallel>: It may contain sub-tours of simple, sequential, parallel and select. Sub-tours are activated in parallel.
<select>: It gives branches to a tour. It may contain sub-tours delimited by <selector> statement. Users can choose from the given sub-tours of simple, sequential, parallel and select.
<selector>: It delimits sub-tours under <select> statement. It may contain sub-tours of simple, sequential, parallel and select.

A navigation script is interpreted by the interpreter program written in Java. In the visualization screen of the script, the current statement is highlighted and the corresponding html-file is displayed on the web browser. Users can use the control panel to move forward and backward. They can also control the web browser directly.

Proxy for Client Log

To trace the behavior of a user's browsing, we made a system, see [Figure2]. User A browses web pages via a proxy server. All requests from the browser is recorded in a log file, see [Figure1]. Each line of log file expresses the time, the size, IP-address, the URL and other information of the request. In the proxy server, a navigation script is generated from information of the log file. On the other hand, User B can obtain the same information by executing a navigation system with the navigation script generated based on User A's behavior.

973823018.563	5458	192.168.0.1	TCPY_MISS/200	30482	GET	http://www.sumitomobank.co.jp/index.html
973823151.733	4719	192.168.0.1	TCPY_MISS/200	16079	GET	http://www.daiwabank.co.jp/
973823184.004	721	192.168.0.1	TCPY_MISS/200	18190	GET	http://www.sanwabank.co.jp/
973823437.748	1934	192.168.0.1	TCPY_MISS/200	5978	GET	http://www.citibank.com/
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.

Figure1: Log file

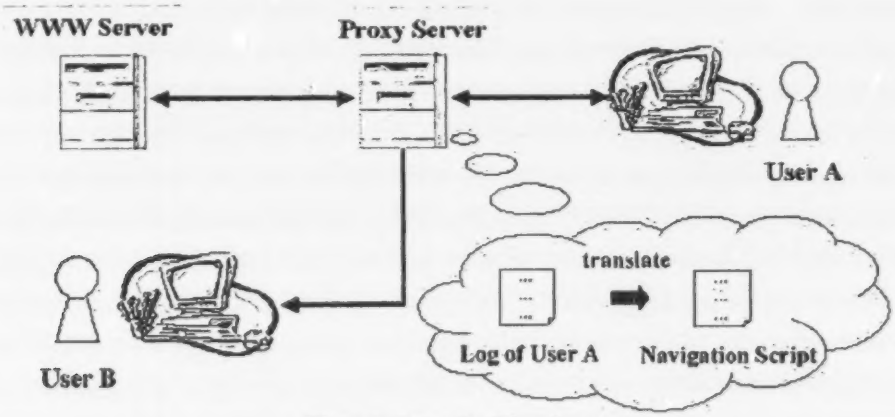

Figure2: Proxy for Client Log

Browsing Log as Footprints on Web Graph

In this section, we explain how to generate a navigation script from a browsing log. Imagine that a user visited several pages and left the following log: a,b,e,m,n,o,f,e,b,g,b,a,c,i,j,k,l,h,p,q,t,r,u,v,w, where a,b, etc. represent URLs. And imagine that these pages are connected like [Figure 3]. The numbers on the nodes represent the time stamps when he visited the page. Note that the page "b" is visited three times and that the nodes "d" and "s" are never visited. In the [Figure3], thin arrows show links between web pages. The thick arrows "e=>m" and "h=>p" do not correspond to any link but show jumps in the browsing. We construct a navigation script as follows. Firstly we extract the URLs from the log and construct the Web Graph (D. Ikeda et al. 1999) whose nodes are URLs and whose edges are links between URLs. Note that not all of the nodes are linked. Therefore, the graph consists of separated sub-graphs. In the [Figure 3], there are three sub-trees whose roots are "a", "m" and "p". Then we try to connect separated sub-trees using time stamps. For example, we connect the node "h" to the node "p", since "p" is followed immediately after "h". We presume that the user browsed the page "p" after he visited the page "h". He might have searched for a new keyword that occurred in the page "h". Then the page "p" may correspond to the page of a search engine with the query. The page "q" and "r" may correspond to the search results. The three time stamps on the node "b" show that the user visited the page three times. There are two possibilities to interpret this log. One interpretation is to assume that he visited the page by chance. Another interpretation is to consider that he returned the page with "back button" of the

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browser. We adapt the later interpretation. Secondly, we generate a navigation script from the Web Graph. We translate the nodes into <simple> statements. Then we interpret each arrow as one of the constructors of scripts, i.e., <sequential>, <select> and <parallel>. When arrows are linearly lined, as in i,j,k,l in [Figure 3], these nodes are lined as members of the same <sequential> statement. The nodes with more than two links, as b,c,p,q,u, are translated to <select> statements with their sub-trees as its members. The node "e" has two kinds of paths to "m" and to "f". The path "e->f" is a link, while the path "e=>m" is a jump. We do not distinguish these paths in translation. Thus the sub-tree that begins with "e" generates the following script [Figure 4]. Finally, we show the algorithm to translate a log into a navigation script, see [Figure 5].

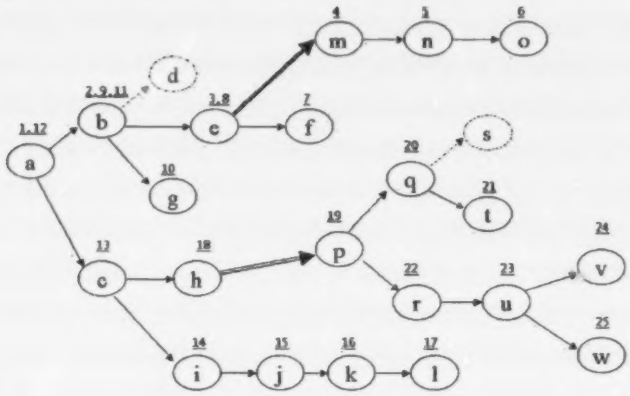

Figure 3: Footprints on Web Graph

```
<sequential>
  <simple>e</simple>
  <select>
    <selector>
      <sequential>
        <simple>m</simple>
        <simple>n</simple>
        <simple>o</simple>
      </sequential>
    </selector>
    <selector>
      <simple>f</simple>
    </selector>
  </select>
</sequential>
```

Figure 4: Navigation Script generated from the sub-tree that begins with "e"

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```
Input: The sequence (U1,T1), ...,(Un,Tn) of URLs
    In the log with time stamp
Step 1: Generate Web Graph G=(N,E)
 N: the set of URLs
 E={(Ui, Uj) | Ui has an HREF to Uj}
Step 2: Separate G into connected components.
 Gi=(Ni,Ei) (i=1... k), Ni . Nj = ., Ei . Ej
 Gi is a tree with the root Ui
 U0 is the start point
Step 3: Make spanning trees Gi* from Gi
Step 4: Construct G* by connecting all Gi*
 for i = 1 to k{
  find the previous node Uj that proceeds Ui;
  connect Uj to Ui;
  }
Step 5:Translate G* into a Navigation Script by Tree2Script(T)

 Tree2Script(T){
 If(T is a leaf){
    output (<simple>T</simple>);
  }else{
    let T=tree(Parent, Child 1,..., Child k);
    if(k= =1){
      output (<sequential>);
      output (<simple>Parent</simple>);
        Tree2Script(Child 1);
       output (</sequential>);
    }else{
      output(<select>);
        output(<selector>);
            Tree2Script(Child 1);
         output(</selector>);
              ...
        output(<selector>);
            Tree2Script(Child k);
         output(</selector>);
      output(</select>);
    }
  }
}
```

Figure 5: Algorithm to translate a browsing log into a Navigation Script

Navigation Script as Knowledge

How to transfer and share knowledge is an important problem in information technology. When one browses web pages, he obtains much information and as a result he increases his knowledge. But it is not easy for other people to have the same experience. We can follow the pages that he saw. But we cannot understand what he was thinking and why he chose the pages. The navigation script can be an approximation of his thought and his experience. We can share his experience by following the script. The script can be a good bookmark for him as well. The script contains not only the list of the pages that he visited but also how he visited. So, he can remember what he was thinking and how he saw the pages.

In educational situation, teachers can use the script to demonstrate the process of obtaining knowledge. At the beginning, teachers keep the browsing log while they search for educational material. Then they convert the log into a navigation script. They can modify the script if necessary. The process is more important than the result. Our system can be used in another way where teachers can analyze the behavior of students.

If we focus on the logs in the same site, the system can be used for the analysis of browsing pattern of visitors to the site. The automatically generated script replays the customer's choice.

Conclusion and Further Work

We proposed a method to generate a navigation script from the user 's log and the link structure of the pages. The script describes how he followed the pages and how he chose the page when there are many links from a page. The script can be used interactive tour guide of the WWW. We implemented a prototype of the system. With this prototype, we are generating many examples of navigation tour very easily. The integration of visualization and the interpreter is not completed yet. The editor for rearrangement of the script is further work.

Acknowledgements

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Combining Summarization with Information Retrieval and Extraction on the Web

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The development of the Internet and the WWW has vastly increased the amount of information available to users. To deal with this "information overload", computer scientists are developing new tools and algorithms. Automatic summarization is becoming an important area of research (still in its infant stages) to help users deal with information overload. The ultimate goal is to have the computer "read" through a long document and automatically generate a summary of the document. However, this is a very difficult task because natural languages are so complex and full of ambiguities. This on-going research takes advantage of techniques in information retrieval and information extraction to help in the task of automatic summarization.

A summary is a brief, concise account of the key ideas in a document. To generate a summary, we must first identify the most important pieces of information from the document and then assemble them into a compact and coherent text. Our research focuses on this first task of identifying the most important information in a document; our implementation produces a summary by extracting key sentences from the document instead of concentrating on full-blown natural language generation of new sentences. Finding the most important sentences in a document is a very challenging part of summarization. Various approaches such as the frequency of words, sentence positions in the text, and the recognition of cue words have been deployed in previous research with limited success (Edmunson 1968, Kupiec et al 1995, Teufel and Moens 1997). Surprisingly, researchers have found that the cue phrase method which looks for cue phrases such as "in conclusion" was the best individual method with 55% recall and precision (Teufel and Moens 1997). Most summarization systems use a combination of many heuristics to improve their results.

Our research exploits the innovative idea of using the user's input in information retrieval and information extraction to help with the task of summarization. The implementation combines a search engine with information extraction and summarization. This allows users to search for information on the web and then see a summary constructed of extracted sentences from the documents. Search engines typically ask the user for key words in order to retrieve relevant documents. These key words can also help in the summarization task because the user will definitely want to see sentences that contain those key words in the summaries of the retrieved documents. However, the keywords are often ambiguous and do not give enough information to construct a good summary. For example, if a user types in the keyword "Washington", they may be searching for information on the person "George Washington", the city "Washington D.C.", the state "Washington", etc. To get more information from the user, the implementation asks for input typically seen in information extraction tasks.

Information extraction tools, often used for data mining, skim through documents in order to specifically look for certain information to extract. This information is then usually placed in a database. The user of these tools often specifies the exact nature of the information to extract. For example, in the information retrieval and extraction competitions sponsored by the government (MUC 1997, TIPSTER 1998), one information extraction task was to extract information about plane crashes, specifically the airline involved, the date of the crash, where the crash happened, the number of fatalities, etc., from newspaper articles online. In general, information extraction tasks seek to fill in information such as "who, what, when, and where" about a certain event. This is exactly the type of information that a summarization tool also needs.

Our enhanced search engine form asks for input keywords for the following categories from the user: Participants, Event, Date, Place, and other miscellaneous keywords. This input is used to identify the information that the user would

definitely like to see in the summaries. The software uses a typical search engine for the results; however, this separation of the keywords into different categories could really be used in the information retrieval task as well. This type of categorization can help the search engine resolve some of the ambiguities in natural language - for example, distinguishing the person "Washington" from the place "Washington".

Most information extraction tools also use pattern recognition to pick out names, places, dates, etc. This is called named-entity recognition and has been very successful. We would like to also combine named-entity recognition with information retrieval and summarization. Users should be able to enter in patterns or use patterns already stored in the named-entity recognizer to pick out any person, any place, any date, etc. This would allow users to ask questions such as "Who wrote the Catcher in the Rye?" or "When was the Declaration of Independence signed?" where patterns would be used for capitalized names or numbers that make up dates. A student researcher in our group is pursuing this area of research.

After the documents that contain the specified keywords are retrieved, they are passed into the extraction and summarization tool. The input parameters and their semantic categories (i.e. participant, event, date, place, etc.) are used to find key sentences to extract and construct the summaries. The summarization tool looks for sentences that have many of the keywords in them. This innovative approach takes advantage of the search engine input to guide the summarization and produce summaries that are custom made for the user. This agrees with the intuition that summaries are often very different depending on their intended audience and purpose.

Sometimes not all the information can be found in one or two sentences. Thus, the summarization tool also looks for sentences that just mention one or more participants and the event that the user entered. The participants and the event are the main parts of a sentence corresponding to the subject, object, and the main verb of the sentence. Additional information such as date, place, and other properties are often found in adverbial phrases attached to the main sentence or in sentences before or after the main sentence connected by pronouns. For example, if the user entered the participants "PanAm", the event "crash", and the place "Lockerbie", the following sentences may be extracted from a retrieved document:

"The PanAm crash was a horrible tragedy ... The people of Lockerbie, Scotland will never forget it."

Our research experiments with different ways to use the input parameters as well as methods such as the frequency of keywords, sentence positions in the text, the recognition of cue words for conclusion sentences, and keeping track of the subject of the sentences, to extract key sentences from documents to produce the summaries. The last method, keeping track of the subject of sentences, looks very promising. As mentioned in the example above, once the main sentence that contains the participants and the event keywords are found, additional information can usually be found in sentences that are connected to the main sentence with pronouns. These pronouns often refer to the subject of the main sentence that matches one or more of the participant or event keywords. In the example above, the pronoun "it" is used to refer to the "PanAm crash". The summarization tool recognizes pronouns and uses heuristics to resolve their antecedents in order to connect other sentences with the main sentences that contain many of the keywords. This natural language heuristic is very promising because it mimics what humans do in constructing summaries.

Our on-going research takes advantage of combining the summarization task with information retrieval and extraction tasks in order to generate custom-made summaries based on user input. The input parameters are used for natural language heuristics to aid the extraction and summarization tasks. Although summarization is a very difficult task, combining it with proven information retrieval and extraction techniques shows great potential.

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The learner as human being – health issues with electronic learning

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Abstract: This paper describes a program of research examining ergonomic and human-computer interface issues related to on-line teaching and learning. We provide a brief description of our preliminary research where we looked at general ergonomic aspects of on-line learning (Fraser, Holt, and Mackintosh, 2000). Through a survey and focus groups with our students we investigated physical concerns, computer-related anxiety and other social and psychological impacts of computers. Several trends and contradictions emerged which we deemed worthy of further study. Students showed anxiety about several aspects of information technology: security, privacy, information overload, loss of data, cost, and keeping up with technology, which were not clearly related. Our follow-up study examined psychological and social aspects of on-line learning in greater depth, using our refined questionnaire and focus groups with nursing and computing science students. The results will be described in the presentation.

Introduction

The purpose of this paper is to describe a research program examining ergonomic and human-computer interface issues related to on-line teaching and learning. First we provide a brief description of our initial research where we looked at both physical and psychological aspects of on-line learning. The main focus of the paper will be on our follow-up research, which entailed a more in depth study of psychological and social concerns students have when they engage in on-line education.

The benefits of distance education, and particularly of on-line learning, have been widely expounded in the literature. Distance education is particularly important for many adult learners as it enables them to meet work and family commitments while pursuing their educational goals. Furthermore, computer conferencing, email and chat lines greatly enhance opportunities for collaborative learning and can help to reduce some of the isolation commonly associated with studying alone by distance education. However, whereas using technology for learning may decrease stress on one hand, on the other, it may provide added stress and discomfort for students.

Stress related to computer use can come in various forms. For example, in a review of studies of computer anxiety in the 1990s, Chua Siew Lian (1997) confirmed that computer anxiety was pervasive despite the fact that computers had been widely used for some time. There is a vast amount of literature and various studies indicating that a large number of people in the general population continue to display signs of computer anxiety as Keen (1998) and Hueser (1998) noted. There are mixed results from research on anxiety in students using computers. For instance, Taylor (1997) observed that students' anxiety decreased over time in their technology enhanced classes, and he subsequently attributed the decrease in anxiety to increased usage and familiarity with computers. It is a common myth that with more experience, people automatically become less anxious about computer use. However, Gos (1998) in his study of university students, found that 94% of the students with anxiety had prior experience, and

students without prior experience had no anxiety about computers. His findings led him to postulate that it may be the quality of prior experience that determines computer anxiety and not simply familiarity with computers. Hara and Kling (2000) in their ethnographic case study of students taking an asynchronous text-based, Internet-enabled course, found that students experienced a great deal of distress. Students reported pervasive feelings of frustration, anxiety and confusion due to technical difficulties and communication breakdowns, coupled with a lack of technical support

There are other concerns about computer use. Orzack (1998) and Young (1999) are among a throng of researchers who identify computer addiction as a growing issue, with a variety of negative consequences, often resulting in familial, occupational, and academic impairment. Kraut, et al (1998) in a longitudinal study of 93 families and 169 participants, found that over the first one or two years of use, greater use of the Internet was associated with declines in social involvement and psychological wellbeing. Internet users showed a decrease in communication with family members in the household, and increases in depression, loneliness and anxiety.

Ergonomics Research at Athabasca University

As faculty members in a distance education university which is offering an increasing number of courses on-line, we feel an obligation to examine potential health and quality of life issues arising from students' computer use. With that in mind, the overall objective of our program of research is to explore ergonomic/human computer interaction concerns related to on-line education, and to subsequently develop health promotion guidelines for students.

Initial research

In our preliminary research (Fraser, Holt, and Mackintosh, 2000) where we conducted a survey and follow-up focus groups with our students, we looked at aspects of computer-related anxiety and other social and psychological effects of computer use. Several trends emerged which we deemed worthy of further study. First, at least some of our students showed anxiety about several aspects of information technology: security, privacy, information overload, loss of data, cost, and keeping up with technology. Second, some aspects of computer anxiety appeared to be relatively unrelated; for instance anxiety about privacy and security issues versus anxiety about keeping up with technology. Third, heavy users appeared to have little concern about the impact that computers had upon their social lives, although there were indications that their social lives (outside of socializing on the Internet) were limited by their heavy computer use. Indeed, some had indicated that their family lives were adversely affected by their time spent on the computer. Fourth, although many users suffered moderate anxiety of one form or another, most did not see themselves as having psychological problems. This study supports other studies that have suggested that the notion of a generalized computer anxiety often cited in the literature is simplistic. Furthermore, while there are facets of computer use that make users uncomfortable, very few students seem to internalize this as a problem with themselves or with their lives. Yet the problems may be more serious than users believe: "There is an abundance of clinical and anecdotal evidence to suggest that there is something about being online that can negatively impact people in numerous ways" Greenfield (1999).

Follow-up Research on Psychological and Social Concerns.

The goals of our follow-up study were to 1) examine learners' psychological and social concerns related to on-line education and to 2) derive possible ways to prevent or alleviate these concerns. We refined our questionnaire and surveyed Athabasca University students on psychological and social aspects of computer use and tried to determine whether students are manifesting any symptoms of over-use. The survey attempted to replicate critical aspects of the previous study but concentrated on psychological/ social impacts and potential amelioration. Focus group discussions enabled us to address pertinent questions in more detail. The results of the survey and focus groups will be presented at the conference.

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Teaching English Modal Verbs with Cognitive Flexibility Hypertext

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Abstract: This paper reports an ongoing Ph.D. program conducted at Department of Didactics and Educational Technology, University of Aveiro, Portugal. The program undertakes to improve English grammar teaching and learning within the field of the English modal verbs at university level based on Cognitive Flexibility Theory (Spiro et al. 1988) employing DIDAKTOS (Didactic Instructional Design for the Acquisition of Knowledge and Transfer to Other Situations) (Moreira et al. 2001), a prototype shell designed on the basis of Cognitive Flexibility Theory.

English modal verbs have long been recognised as an area of notable difficulty for English learners at all levels of language learning (Haegeman 1983, Harris et al. 1997, Palmer 1986). The problem can be mainly attributed to their manifold meanings. The difficulties of interpreting an already complex system is compounded by the out-of-context, oversimplified, fragmentary teaching methods like providing a list of modals together with their corresponding meanings which lead to students' over-generalisation. Students may recognise or memorise the modals with their accompanying meanings but they fail to produce them in speech, a typical symptom of failure of knowledge transfer.

Within constructivist theories of instruction and learning, Cognitive Flexibility Theory (Spiro et al. 1988) provides remedy to problems associated with advanced knowledge acquisition, i.e. learning beyond the initial stage of a subject area in ill-structured and complex domains. It advocates avoiding oversimplification instruction, providing multiple representations of content, emphasising case-based instruction, context dependent knowledge, knowledge construction and not transmission, and introducing complexity at an early stage. A central metaphor associated with Cognitive Flexibility Theory is the criss-crossing of conceptual landscapes revisited from different directions in order to master the complexity and fullness of a domain, a metaphor originated from Ludwig Wittgenstein's philosophical work expounded in *Philosophical Investigations* (Wittgenstein 1997). By criss-crossing the same area from different perspectives, a web-like form of highly connected knowledge structure is created, allowing for flexibility in the application of knowledge to novel situations. A shift from single to multiple representations, from rote learning to knowledge assembly, from schema retrieval to situation-specific knowledge assembly should be realized: "information that will need to be used in a lot of different ways needs to be taught in lots of different ways" (Spiro et al. 1987)

The method most appropriate to translate the principles of Cognitive Flexibility Theory is hypertext as hypertexts provide non-linear links that allow for multiple dimensions of knowledge representation and multiple interconnections across knowledge components. These features enable learners to interact in an interconnected environment that avoids generating reductive bias which take the forms of oversimplification of complex and irregular structure, over-reliance on a single basis for mental representation, over-reliance on 'top down' processing, over-reliance on context-independent conceptual representation, over-reliance on precompiled knowledge structures, rigid compartmentalization of knowledge components and passive transmission of knowledge (Spiro et al. 1987).

Founded on the theoretical orientations of Cognitive Flexibility Theory, DIDAKTOS, a cognitive flexibility hypertext prototype, permits teachers to create hypertexts presenting any subject via different media (text, images, sound and video) when teaching ill-structured domains at the advanced knowledge acquisition stage. The instructor can create or edit cases presented in different forms, add descriptions of the cases, explain

how the themes are applied in each case, the contexts in which the cases appear, and make notes while scripting. What is more, the instructor can build special sequences to call students' attention to the connections between cases. Students can view the cases one by one, consult the descriptions of cases, themes, and contexts, look for specific themes, get special sequences, and make notes. Right now DIDAKTOS is being evaluated empirically in the present work as well as by Torres (in progress) in the area of Impressionism.

The present work strives to find out if subjects studying modal verbs in a non-linear format can achieve better levels of acquisition than subjects receiving a linear presentation of the same content and if their epistemological learning preferences influence the acquisition of this grammatical area and what the subjects' motivation and attitudes towards using this hypertext program are. English modal verbs (can, could, may, might, need, must, shall, should, will, and would) will be presented in small chunks in different contexts from distinct but complementary perspectives (normative grammar, systemic grammar, functional grammar, communicative grammar, pragmatics etc) with different levels involved (social level, socio-linguistic level, and situational level). Mini-cases of different genres (songs, video clips, newspaper articles, essays, and poems etc.) will be introduced via audio, video, graphs, and text.

Two hypertext learning environments with different structures will be created using DIDAKTOS, one in a linear, traditional way and the other in a flexible, non-linear, thematic criss-crossing way that demonstrates the conceptual interconnectedness between abstract concepts and context dependent case-specific knowledge components. Thus two groups (N=40) will be engaged. The control group will study the materials in a traditional, linear way while the experimental group will look at the hypertext with a non-linear, criss-crossed, flexible structure of content material presentation format. Pre and post tests of the subjects' factual and procedural knowledge of the modal verbs (including near transfer and far transfer) will be administered to find out whether any change will occur after the experiment. At the same time, the epistemological beliefs and preferences of subjects as regards their perception of the nature of leaning and that of knowledge before and after the experiment will be examined to determine whether there will be changes and whether it affects learning. Quantitative data obtained during the experiment will be analysed statistically. The subjects from the experimental group will be interviewed to explore their motivation throughout the experiment, opinion on the structure of the hypertext, and usability of the hypertext.

Right now, the hypertext is being scripted, themes are being delineated, and cases are being chosen. It is our belief that students will get a better understanding of this knowledge domain in terms of factual and procedural knowledge after using the program and DIDAKTOS will turn out to be an effective teaching and learning tool.

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Creating a Framework for Academic Web Strategic Planning

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Abstract: This paper describes a Web strategic planning process at the James H. Quillen College of Medicine (COM) at East Tennessee State University (ETSU). The process began when a Web Strategic Planning Committee was charged by the Associate Dean of Academic Affairs to craft a comprehensive plan for development of the COM Website, because the existing Website did not serve the needs of students, faculty, staff, or the community. Elements of existing internal documents served as the foundation for developing the strategic plan. The resulting framework outlines guiding principles, current conditions, planning assumptions, and strategies. Strategies were aligned with the COM mission and goals. Recommendations and a framework for implementation were delineated. The resulting living document serves as a guide to help align the COM mission, goals, and values with the information technology infrastructure. It soon became evident that the original charge had broader implications affecting areas such as leadership, instruction, resources, training and support, content, quality control, and technology integration. Because these are common concerns in academia, this strategic planning process may serve as a framework for other institutions.

Introduction

Who We Are

East Tennessee State University (ETSU) is a regional comprehensive university of approximately 12,000 students and has a medical school with 250 medical students and 270 residents. The College is dedicated to excellence in medical, biomedical, and health education, research, and the improvement of health care in northeast Tennessee and the surrounding Appalachian region. The James H. Quillen College of Medicine (COM) is one of the last six medical schools established in the U.S.; the first class graduated in 1982. According to **U.S. News & World Report** (April 2001), the College tied for fourth place among the top medical schools in the nation for rural medical education.

College administrators had been aware for some time that the existing Website did not serve the needs of the students, faculty, staff, or the community. In addition, a change in administration and the departure of the sole Website administrator resulted in a chaotic state of affairs for the site. It was in this new environment that administration appointed the COM Web Strategic Planning committee and charged it with the task of producing a strategic plan. This task was to be accomplished within the timeframe of two months. The committee consisted of two representatives from the Office of Information Technology, two faculty members, one library representative and three staff members (two from the department responsible for the

COM Website). Since the committee appointees had little strategic planning experience, one of the first things to be done was to educate the members about the strategic planning process.

Strategic Planning

Strategic planning provides a means for an organization to adapt its services and activities to meet changing needs in the environment. A strategic plan is a framework that guides choices to improve and restructure programs and management, and to evaluate an institution's progress. The planning process provides direction, envisions the organization's future, and examines values, the situation, and the environment. It is a tool to align the goals developed by the planning committee with the mission and goals of the organization. A strategic plan decreases in value unless the follow-up process includes developing an implementation plan and making provisions for evaluation and continuous improvement (Fig. 1).

This document outlines a framework for creating both an academic Website strategic plan and an implementation plan. It also emphasizes the need for a formalized evaluation and continuous improvement process.

Figure 1. Strategic Planning Process

The Strategic Plan

The original interpretation of the charge was to develop a strategic plan for the COM Website. The process began by painting a vision and establishing goals for the Website, outlining guiding principles, current conditions and planning assumptions, aligning committee goals with the College mission and goals, and recommending the development of an implementation plan, as well as a process for annual evaluation and continuous improvement (Fig. 2).

Painting the Vision and Establishing Goals

The first step was to conduct a brainstorming session, during which the committee began to build a vision by articulating a desired future state of the Website and related technologies at the College. This session resulted in a vision for the Website to become a core tool to facilitate communication. The Website should enhance the ability of the College to perform its mission, reflect its image, and increase visibility by serving constituent needs. The committee goal was to create a Website that supports the COM mission.

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First, potential users were identified. The internal COM audience was recognized to include students, administration, faculty, and staff. The external audience was identified as prospective students and employees, the local community, business partners, government agencies, and funding sources. Second, the purpose of the Website was defined, which is to educate physicians and biomedical scientists, inform both internal and external constituents, recruit faculty, staff, students, and funding sources, and nurture constituents. Third, the purpose of the charge was discussed and problem areas were outlined. Simultaneously, a literature search was conducted. While some literature exists about strategic planning at the university and information technology levels, the search revealed that little applied to academic Websites.

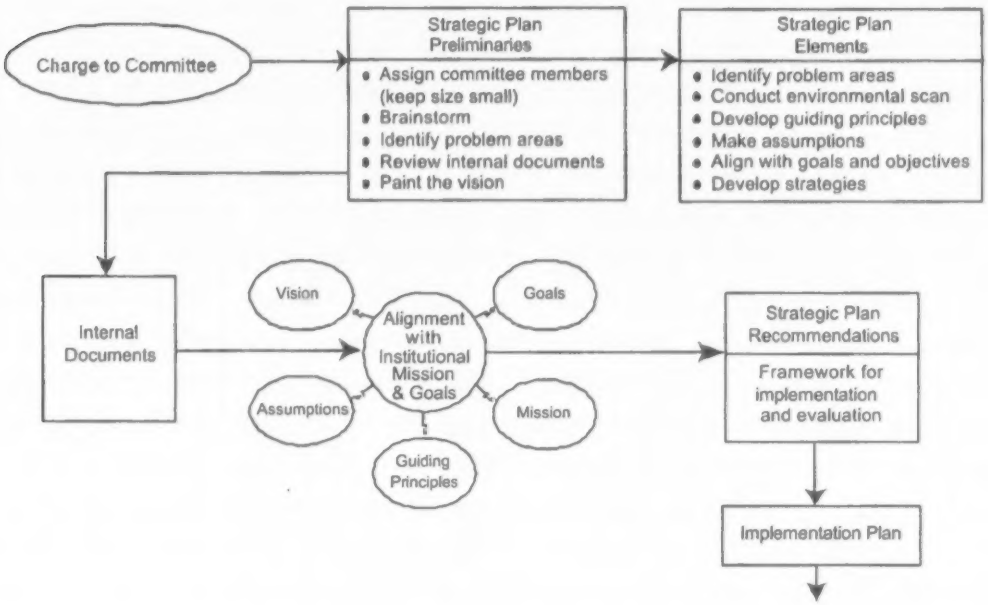

Figure 2. World Wide Web Strategic Planning Process

Guiding Principles and Assumptions

Guiding principles are fundamental value statements that govern decisions and actions. These principles serve as a framework upon which infrastructure is built. At the COM, the goal is to build the framework on the acquisition and consistent use of technology throughout the College. As an example, one of the committee's guiding principles is to build and maintain a high-quality Web infrastructure that supports learning, teaching, research, community outreach, and the goals and objectives of the institution.

Planning assumptions outline the environment in which an organization exists. The committee scanned the COM environment and evaluated the state of the Website, as well as the organization of resources within the College. This environmental scan resulted in assumptions about students, administration, faculty, staff, the community culture, resources, and technology that guided decisions and recommendations.

Developing Strategies

For the Website to be an effective tool to deliver information, instruction, and other resources, strategies must be aligned with institutional planning efforts and committee goals. The committee used internal documents, including strategic plans for the University, the College, and the Office of Information Technology, to align

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established goals and objectives with those developed by the committee. Strategies were developed to attain those goals (Tab. 1). Finally, prerequisites for implementing the strategies were identified.

To Enable Efficient, Effective, And Meaningful Use Of The Web To:	Web Planning Committee Strategies	Prerequisites
COM Goal #3: Promote an academic environment that nurtures research and scholarly activity **Committee Goals:** 3.1 Internal Nurturing	3.1.1 Improve access to library resources 3.1.2 Provide a searchable database for ongoing research and clinical interests 3.1.3 Provide a Web platform for collaborative consultation 3.1.4 Provide a Web reference room with appropriate links, forms, databases, and templates	? Administrative support to allocate resources ? Need standardized interface

Table 1. Strategic Plan Example

The Implementation Plan

An implementation plan is a path to the future that assesses and analyzes the needs of the institution and its constituents. The plan prioritizes core issues that are unique to the institution. The implementation plan recognizes that the Website is a critical component in the strategic planning and budgeting process.

Once the strategic plan was accepted by administration, the implementation planning process began. The committee had six months to complete the task. The implementation plan (Fig. 3) was developed by:

1. Interviewing constituents to determine their concerns
2. Analyzing information from the interviews
3. Prioritizing action items
4. Identifying resources and making recommendations

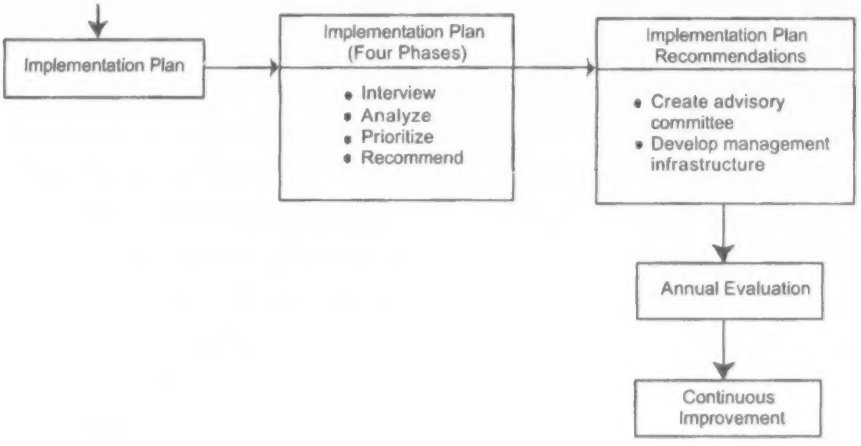

Figure 3. World Wide Web Implementation Planning Process

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The traditional method for soliciting input is to develop a survey instrument. Because of time constraints, however, personal interviews were determined to be more efficient for gathering information. The interview audience was divided into two tiers. Tier one included academic and critical administrative units; tier two, special programs. Second tier interviews were postponed because first tier concerns were so consistent. When the information was analyzed, the committee discovered that problems involved more than the Website. Major concerns fell into three broad areas—user-related (delivery of instruction, collaboration, marketing, and public relations), Web-related (training and Web design), and technical-related (network infrastructure and use of databases for dynamic delivery of information). Consistent issues emerged as core topics; for example, there is a need to develop an information technology organizational infrastructure and to promote more effective internal communication. The committee prioritized core topics and made specific recommendations to help solve the identified problems.

Lessons Learned

Many lessons were learned during this process. For instance, non-experts in strategic planning are capable of creating a Website strategic plan for the institution. A little wheel spinning initially is acceptable or even desirable—working through initial struggles permits members to get to know each other and establish a productive, collaborative relationship. Other lessons learned were:

- Keep the committee small, but represent the constituents
- Stay flexible to accommodate the unexpected
- Set a timeframe
- Examine the successes and mistakes of other institutions
- Establish benchmarks prior to the evaluation process

Conclusion

The strategic plan for the ETSU College of Medicine technology infrastructure is not a rigid blueprint, but a living document to help align the mission, goals, and values with the Website strategy. The effectiveness of any strategic plan is not only implementation of the plan, but the extent to which goals are met. Therefore, an annual evaluation process, based on established benchmarks will be proposed. Following evaluation, a formalized continuous improvement process should be implemented to provide the institution with a method to analyze progress and re-evaluate goals.

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Research Findings on a Virtual Training Center – Measuring Web Based Training as an Effective Project Management Facilitation Intervention.

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Abstract: The Virtual Business Training Center (VBTC) is an integrated business resource center that provides students with access to online market research, project management, and other project-based data analysis opportunities. It also functions as a business lab and virtual training for business partners. We use this unique virtual project environment to facilitate the access of project data by students (retrieval, analysis, then evaluation), re-post as Work in Progress onto web-based environment for business partner's participation, then edit or move on to the next project phase. Our current research results indicate that the web-based environment enhances access to both volume and timeliness of data and information. This virtual training platform also speeds up analysis, and contributes to more effective project completion. The contribution to project success was measured by adherence to schedule, to agreed-upon deliverables, and to resource allocation.

Introduction

A key online business relationship exists when an organization, facilitator, and learner interact within a technology platform to develop workplace performance. These technology tools can help learners (both students and employees) target and reach their highest performance objectives quickly and with reduced trainer support. In project based classes there are exciting opportunities for problem solving to be facilitated by advanced and interactive technology interventions. New knowledge can be gained by exploring unique applications of technology platforms that facilitate project deliveries. Preliminary results indicate an increase in interaction and access (participation) of data usage, analysis of data, and facilitation work by nearly three-fold compared to traditional face-to-face project environments. Our study also reflects the number of interactions between team members and the facilitator increasing on average from 22 to 48 contacts in the web-based environment. Quality gains have been observed including an increase of at least 25% of required deliverables completed. Total project completion to schedule increased from 0% on time completion in traditional project delivery to 80% using the web-based environment. A summary of the baseline and web-based intervention environments are included in Research Design section under Background subheading of this paper. A developmental assessment effort can be used to study existing online web-based intervention platforms and their effectiveness in facilitating a project-based delivery. The focus of this paper is on the design of an assessment plan that can accurately measure the impact of using web-based deliveries to increase performance. The full discovery of this relationship requires a quick review of key trends in technology and training and then a full examination of effective assessment of online training deliveries.

Growth Trends in Technology Based Training and Instruction

There has been a tremendous explosion in the types and use of technology to deliver workplace and learning education objectives. Each technology platform has seen growth with the web-based training platforms growing fastest. Some important growth trends are highlighted by the following American Society for Training and

Development (ASTD) 1999 statistics; 30% of all training delivery types are technology deliveries, only 3% are high end interactive (EPSS) technology deliveries, the use of multimedia has risen from 12% to 22% the last two years (up to 81% with companies with progressive training strategies – designated as benchmark companies), British Open University and University of Phoenix alone has grown from 10,000 online students in 1990 to over 50,000 in 1998 (ASTD 1999), and projected growth of technology based delivery for training for 2002 is 55% an increase of 25% from 1999 (Salopek 1999).

Assessment Trends in Training and Education

There is a glaring disparity when you observe the rise of inclusion of technology in training/education while there exists a relatively low measurement of its effectiveness. The following statistics highlight some recent trends; 94% of surveyed companies assess training at Level 1 assessment which reflects no increase from 1996, 53% of surveyed companies assess training at Level 2 assessment, 29% increase from 1996, 32% of surveyed companies assess training at Level 3 assessment, 19% increase from 1996, 28% of surveyed companies assess at Level 4 assessment, 25% increase form 1996, output data collected (number of people receiving training, number of training offerings, $ spent on training, etc.) consistently lags behind input data collected (productivity, customer satisfaction, return on investment, sales, waste reduction, etc.) by 20% in almost every category, 94% of survey companies use questionnaires to assess, a low of 40% use performance records (ASTD 1997).

Assessment Challenges

The technology is used as a set of intervention tools to develop significant performance improvements. International Data Corporation's Research Manager Ellen Julian expresses the challenges as a maturation of Information Technology (IT) infrastructures that can now accommodate web based training, high interest among companies to pilot online learning systems, and an increasing pool of knowledge to implement those technologies. As an example she cites the recent acceptance and use of state of the art online chat to facilitate online training and now it is already jumped to implementing live, real time video conferencing and collaboration over the Internet (Julian 1998). The following items outline the key challenges that educators and trainers face when integrating online technologies into their delivery systems: technology developments occur faster than adoption, technology adoption occurs faster than assessment, and the most immediate evaluation challenges in business and education involve focus on expertise and commitment

New Knowledge Requirements

New Knowledge is where many training facilitators and university faculty must pause and consider their actions. Are the online interventions being used effective? Do the online interventions improve performance areas targeted? Are the online interventions more effective for the majority of the learners? Can learning using online interventions be measured? Can application of learning be measured? Other questions can and should be addressed as innovative online technology tools continue to be introduced and requirements for employee performance development increases. The burden at this point is obviously shifting from what can be done using online technology platforms to which ones work and where are they best applied. Unfortunately this is a forgotten task of trainers and faculty, we plan and do and then plan and do again without gaining key knowledge of the effectiveness of our techniques or tools. Assessment represents the set of activities that moves from doing (implementing a new online component such as video conferencing) to studying the doing action and determining whether the intervention actually made an improvement in learning or application. If we have quantitative and qualitative based knowledge in a particular online intervention that did or did not improve learning or application then we have new knowledge – assessment's ultimate goal. The process for effective gain of this new knowledge includes four steps.

Planning an online intervention – This step is not an arbitrary action guided by what technology is available or most innovative but rather a structured and focused plan. After initial defining activities selection of a subsystem to improve takes place, the improvement effort exposes identifiable skills or knowledge gaps, and then a baseline needs to be taken. What level of skills do learners possess right now? What is the level of performance exhibited currently? What is the level of satisfaction that customers of this subsystem express? What is the current training intervention used to improve these areas (classroom deliveries, CBT, etc)? This balanced measure baseline will provide data that can be used later to determine whether a new and innovative online technology training intervention has actually made an improvement in skill and knowledge application and whether that imp rovement has had an impact on exhibited performance, customer satisfaction, and competitive position. The gap between the

existing performance and desired performance is the next piece of the plan to be examined. These planning activities include identification of all the interferences between the existing performance and the desired performance. Finding the most significant interference prepares us for the next stage of a new knowledge quest.

Implementing an online intervention – Immediately after planning the training focus area that requires performance improvement selection of an appropriate online intervention is considered. The elimination of the significant interference becomes the criteria for selection of which online intervention will be best to try. At this point a match of needs, expertise and availability of technology can be maximized. A small intervention change should always be attempted first before major investments are taken and because we do not yet have knowledge of the effectiveness of the technology intervention.

Assessing the technology intervention – Quantitative and qualitative examination of the intervention as it compares to the baseline. The design, collection, analysis, and evaluation of the data results will determine whether the online technology training intervention had the desired impact, did it work?

Standardize the use of the online intervention – this step may also include the abandonment of technology interventions that do not make improvements in learning and application. Increasing retention of information that does not increase student/employee performance is not improvement and should not be used to determine technology intervention effectiveness. If an online technology intervention has been documented to improve a training output (learning and application) then the improved training intervention should be standardized. The new technology intervention should be implemented on a larger scale than the pilot. It can be used to deliver other knowledge or skills area needs (i.e. sales to software instruction) or used for all learners in a particular skill area.

Framing the Assessment

Assessment Problem Component 1 – Exhibiting Business Knowledge and Technology Skills

The project based approach is a technique, pedagogy, and delivery of business info into university and training environments and an integral piece of improving the effective training of future business leaders. Project work in general provides an environment where learners exhibit a direct, hands-on application of business skills, knowledge and attitudes. Learners have the opportunity in this environment to develop key business skills that are difficult to deliver in the traditional classroom format. The project based approach functions as a "pull" system, much like successful and innovative production control systems that require parts to be delivered only as they are needed using a Just in Time (JIT) system. Pulling the business content requirement and technical skills into the project/classroom at exactly the time learners need those enablers optimizes the benefits of experiential learning project work. It also increases the range of applications of various business skills. The question of what type of enabler (skill intervention) is needed is matched with what best enables the successful completion of the project component. The project also is the significant criteria for what should be introduced (knowledge intervention) as preparation. The timing of the required training intervention is determined by the immediate needs of the project team in resolving project problems. A comprehensive project based program will require the understanding and usage of relevant knowledge and expertise. The real time nature of projects should eliminate the expended time lag between the receipt of theoretical information and its implementation in solving problems.

Key training highlights of this Just in Time / Pull approach include; less Work In Progress – stockpiling information eliminated, quick response to problems – completion of projects require skill and knowledge gaps to be addressed immediately before progressing further, better quality – duplication of skill, knowledge, and attitudes is known and avoided by students and faculty (do it right the first time), better market response – actual business projects are as dynamic as business environment, student confidence – building cycles of success, supports practice, increases level of participation, develops levels of leadership and teamwork.

The Pull system approach - delivery and pedagogy highlights for faculty and students include; opportunities to test and refine change and improvement theories, requires exhibited knowledge, raises awareness level of business success and potential, raises awareness level of team success, raises awareness level of professional and personal success, presents challenges requiring more than one set of skills or knowledge bases, requires depth and of content and application expertise, ream centered, problem solving emp hasis, learn how to learn emphasis/self directed learning

Assessment Problem Component 2 – Making Projects Work

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A comprehensive project-based approach puts tremendous pressure on the use of project management skill of both learners and facilitators. In addition, the pull system success is directly hinged to successful project completion. Unsuccessful project completion compares to covering 7 of 22 chapters in a textbook based course, the textbook range is the basis for required body of knowledge. A completed project meets the body of knowledge requirement for project-based approaches. With this in mind, executing the project effectively and efficiently is paramount to learning and success. Our recent work with technology platforms specifically focuses on more effective project management. An innovative use of online technologies is not just an alternative to be used in project based business classes, it is a better platform. An online platform in a training setting will increase participation of learners, provide more opportunities for critical thinking, enhance communication between team members, enhance communication between business sponsor/faculty facilitator/student team, increase probability of achieving required deliverables, quicker responses to faculty interventions, project closer to planned timeline schedule, more communication between team members, clearer exhibition to business skills and knowledge, more cohesive group work, project completion closer to planned specifications, earlier interaction with facilitator/faculty, earlier interaction with business sponsor, and greater number of outside experts involved with project.

Research Project Description

This applied research project will focus on examining solutions to practical problems experienced in project based classroom deliveries. This Type I Developmental Research will emphasize the study of a specific online technology platform and its use and will produce a research output that articulates lessons learned from analyzing this online technology platform in use to facilitate business projects in the workplace and college environments.

Research Questions

Can online platform improve access (increased volume – quantitative) to resources (information, data, team members, etc.)? Can online platform improve interaction (increased effectiveness – qualitative) with and among resources (team members, facilitator, sponsors, data analysis, etc.)? Can improved access and interaction through online platform improve project management success?

Are students (more?) satisfied with use of online technology to facilitate team project activities? Are students (more?) satisfied with the results of online technology toward project completion? Are students (more?) satisfied with online technology as a learning environment? Is faculty more satisfied with student participation and demonstrated expertise?

Assessment/Research Hypothesis

Can a high end and interactive online training environment enhance access and interaction of team member activities and improve project completion?

Project Statement

To improve the high end interactive online training environment as measured by frequency of access and interaction and successful project completion.

Operational Definitions for Project Statement/Hypothesis

- Access
  1. Information – schedule, work in progress, problems, questions
  2. Expertise – technical, analysis, project management
  3. Software applications – spreadsheets, scheduling, statistical analysis, etc.
  4. Planning – with sponsors, team, facilitator
- Interaction (textual or interactive multimedia using technology tools from remote locations)
  1. Synchronous – real time discussions, presentation of information or data, planning activities, consensus/decision making sessions, work sessions analyzing or stratifying data, and project status reporting.

2. Asynchronous – separate time activities that include online discussions, presentation of information or data, planning activities, consensus or decision making sessions, work sessions analyzing or stratifying data, and project status reporting.
3. Just in Time interventions – the opportunity for interventions with timely expertise. Facilitators can arrange skill based or knowledge based interventions as they observe online team activities.

- Successful project completion
  1. Deliverables – meeting agreed upon outcomes at agreed upon quality levels that become the specifications of any project.
  2. Adherence to Project Schedule

Research Design

The proposed research project will model a Type I developmental study that aligns with more traditional evaluations where the primary research focus will be on the product/program evaluation and not the development process. The development process will be described and analyzed while the online platform, as a product, will be evaluated. This research project proposes to study the impact of an existing (recently developed) online platform (product/program) on student performance with actual business projects. The product of this research will clearly be a report on lessons learned from the use of a unique online platform to facilitate and impact student teams' effective and efficient work on business projects.

Background

The evaluation of the web-based intervention will be established within a quality operations course. This Quality Principles course has 3 main learning components; review of foundation principles of quality theory, supplemental discussion issues in quality applications today (team building, organizational culture, leadership, etc.), and a business project simulation. The business simulation is an actual Continuous Improvement project completed for a Midwest organization that has been transitioned into an interactive project simu lation. The project is very structure in the problem solving process as well as its required outputs, schedule, and level of accuracy. Students work in teams on the project by moving through the Plan-Do-Study-Act cycle. The cycle is broken down into a 7-phase problem solving approach with required procedures and techniques for data gathering, analysis, consensus, and decision-making. The project schedule identifies specific outputs to be completed through out the problem solving sequence including flow charts, control charts, Cause and Effect diagrams, and Pareto Diagrams. The prompt and interaction cycle is flexible but typically follows a facilitator prompt, intra team interaction, project schedule management, facilitator intervention, Work in Process outputs reviewed, team or individual interaction with the facilitator, project outputs, next prompt from facilitator.

The baseline class completes the entire project in the classroom (computer lab) with minimal outside of class interaction. A traditional business meeting format includes the team interaction as well as the facilitator/faculty participation. The meetings include work activities such as general feedback, tool development instruction, process prompts, and software application instruction.

The web-based intervention is integrated in an identical section of the quality operation course. The three main learning components remain the same with the exception being the web-based delivery and project interaction of the Continuous Improvement project. The project is facilitated entirely online including all feedback, tool development instruction, software instruction, etc. Lotus Domino and Course Info's Blackboard platforms provide threaded discussion boards, real time chat function, e-mail, file posting capability, and online work space usage.

Data to be gathered

Primary data to be gathered on frequency of access and interaction and successful project completion includes: attribute data counts on number of uses of online features (chat function, desk top video conferencing, discussion board postings, etc.), variables data on amount of time using online features as % of time on project with team and as individual contributor., attribute data on number of contacts with project data, team members, analysis features, communication, and project status information., attribute (yes/no) data on meeting project specified deliverable milestones, and attribute (yes/no) data on meeting project specified schedule milestones.

Sub study data to be gathered includes: qualitative data on student satisfaction with online platform, qualitative data on student satisfaction with project completion, qualitative data on student satisfaction with online learning environment, qualitative data on faculty satisfaction with student's demonstrated expertise and participation

Methods of Data Collection

Descriptive research method – This research method will be used to describe what is the impact on using online interventions for access, interaction, and project completion. We will summarize data (basic central tendencies – i.e. mean number of chat room intervention usage, variations – i.e. variation of measured time interacting with data posted on web site, percentages – i.e. percent of students satisfied with use of web based environment to drive business projects, and correlation between variables – i.e. measure the relationship between those students who indicate a positive attitude toward web based platform usage and number of times interacting with video conferencing feature) and review it for explanations specific to successful online interventions for effective project management. The descriptive research will also provide validation on the level of effectiveness interactive web based platforms can have on project completion.

Method of Data Analysis and Instruments

Descriptive statistic analysis – analysis will include graphics that aid in data stratification, consensus building, analysis, and decision-making. Instruments will include surveys and tally sheet/observation. This analysis will be used to represent the respondent profile, basic levels of satisfaction with online platform, baseline levels for project activity usage of online technology components (chat feature, desktop video conferencing, etc.), descriptions of use of each technology component (chat feature for brainstorming, desk top video conferencing for team data analysis, etc.), and measurement of intervention impact on team project performance. Instruments will include spreadsheet software (Excel), statistical software (SPSS), and presentation software (PowerPoint).

Cross tabulation Analysis – analysis will include graphics that aid in the interpretation of key relationships in attitudes, technology usage, and technology effectiveness. Instrument will be a survey. Software will include statistical software (SPSS) and presentation software (PowerPoint).

Variation Analysis – analysis will include attribute and variables data recording, control chart design, and control chart interpretation. The instrument will be observation/tally sheet, participant responses on checklist, and survey. This analysis will be used to represent the performance of data collected over time including counts of each tech component usage during project activity, time spent with each tech component during the project activity, determine special cause variation existence, etc.. The performance tracking will be used as baseline and as measurement to determine whether online interventions improved access, interaction, and project completion. Software will include Statistical Process Control Software (SQCPak).

Attitude Pattern Profile – analysis will include qualitative interpretation of discussions including attitude toward online technologies, use of technologies in education, use of technology in project management, team building, etc. The instruments will be interviews and focus group. This analysis will be used to verify and expand information collected and analyzed from surveys.

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A Web-Based Lesson with Situated Learning in Senior High School Level

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Abstract

This article presents the development and evaluation of a web-based lesson developed to cultivate situated learning. This research project employs the quasi-experimental method along with semi-structured interviews to investigate the effects of a web-based lesson on science learning in the senior high school level. Three classes of second-year students from two senior high schools in Taipei were selected as the participants for this study. The total participants were 110 including 49 males and 61 females. The statistic results indicated that (a) students' conceptual progress almost reached a significant level ($t=1.98$, $p<0.051$) before and after the experiment, (b) there were significant differences between male and female students on their conceptual progress before and after the experiment ($F=11.48$, $p<0.001$), and that (c) most students had positive opinions about this web-based lesson. From analysis of qualitative data indicated that some students thought that the web-based lesson, named Lesson Rainbow, provided a daily-life situation could promote their motivation on learning and help them integrate knowledge.

Keywords: Web-Based Learning, Situated Learning, Hypermedia, Science Learning

Introduction

Arising from the popularity of the WWW, education network computer applications have recently become one of the most promising education tools. The Internet provides a variety of tools for acquiring information and for thinking and allowing more students more ways to construct knowledge (Riedling, 1999). This facilitates students developing a broad, deep, and creative understanding of the available information. Based on the research reviews by Berger and others (1994), technology should be applied in fanciful and creative ways to aggrandize cognitive learning for students. These experiences provide the skills that will enable students to live productive lives in the global, digital, information-based future (Dwyer, 1994).

The merging of various types of media allows learners to select their own mode/representation during learning and make associations or links between the various representations. The digitization of media and the rapid growth of networks make the storage and retrieval of digital material, local or remote, possible. Multiple-model instructions meet individual students' needs and make learning efficient and independent. Internet technology can not only integrate the advantages of traditional CAI into instruction but also provide a variety of learning environments from self-directed learning to individual learning, one-to-one interactive learning, group learning, and situational learning (Mason, 1995). With the Internet, students are able to work with current data that are much more up-to-date, and authentic than the material in textbooks. Online resources can help students make connections between their schoolwork and the concerns of people in the real world. In these ways new technologies can make learning and curriculum more generative (Wiske, 2000). Many research have shown that the web-based instructions had positive effects on students' learning motivation, scientific attitude and learning efficiency (Hsu & Thomas, in press; Krajcik, 2000; Edelson, 2001; Hoadley & Linn, 2000). Most of these research concluded that the positive effects came from a careful design on web pages, learning

materials and web managements. The benefits of web-based instructions are not reaped automatically but only come as a result of careful planning.

In this study, we chose the theory of situated learning as the theoretical base for the development of a web-based lesson, named "Lesson Rainbow". It is because most of teaching contents and processes in the schooling activities do not part from real-life situations. This causes that students can not apply their learning to solve problems in their real life or in their working places. Educational reform in many countries focuses mostly on lifelong learning and transfer of what students learn to real-life situations (Ministry of Education in Taiwan, 1999; National Science Education Standards, 1996). Situated learning emphases that learning occurs in real situations and the construction of knowledge is in the continuous interaction between human and formerly situations (Brown et al., 1989; Lave & Wenger, 1991; McLellan, 1996). This leads students gain synthetic knowledge instead of inert knowledge. Three ways of realistic situations can be used in class: (1) taking students to the real workplace; (2) immersing students in an authentic or similar situation; (3) providing students an anchoring context (McLellan, 1996).

Many researchers suggested that computer hypermedia and networking technology are effective tools to simulate realistic situations when a realistic situation can not be provided in a traditional classroom (Winn, 1993; Hay,1996; McLellan, 1994; The Cognition and Technology Group at Vanderbilt, 1990, 1997; Harley, 1993). If learning activities can make a connection between the real situation and its underlying theory, it is realistic to learners (Moor et al., 1994). If computer multimedia can simulate realistic situation in a meaningful way, it can make learners to immerse in and to feel it realistic. This study attempts to develop a web-based lesson according to the theory of situated learning and to examine how the Internet supports situated learning.

Method

This research project employs the quasi-experimental method along with semi-structured interviews to investigate the effects of a web-based lesson on science learning in the senior high school level.

Participants

The participants for this study were selected from two senior high schools (called as School **A** and School **B**) in Taipei. They were second-year students and their majors were social sciences. There were four classes who enrolled in Earth Science class in School **A** and two of them were randomly chosen as our participants including forty-four males and forty-two females. One of two classes who enrolled in Earth Science class in school **B** were selected randomly as the sample including 16 males and 30 females. Totally, the participants were 132. After excluding invalid data, the number of the valid sample was 110 (49 males and 61 females).

Instrumentation

Besides the web-based lesson (called as Lesson Rainbow), there were other three instruments that were developed to collect data in students' conceptual progress and their opinions about the web-based lesson. All instruments used in this study were validated by the experts. The characters for each instrument are shown as

follows:

1. Lesson Rainbow (The homepage of Lesson Rainbow is shown as Figure 1): McLellan (1996) suggested there are eight key components including in situated learning: stories, reflection, cognitive apprenticeship, collaboration, coaching, multiple practices, articulation of learning skills and technology. Five of them were designed in Lesson Rainbow except for cognitive apprenticeship, coaching, and articulation of learning skills. The mapping between these components and Lesson Rainbow is shown as below (see Table 1):

Figure 1: The Homepage of Lesson Rainbow

Table 1: Mapping between the Components of Situated Learning and the Designs of Lesson Rainbow

Component	The mapping design of Lesson Rainbow
Stories	The designs of the animations display realistic situations about a story about a trip to the northeast coast in Taiwan.
Collaboration	The function of asynchronous online discussion provides students an opportunity to form a virtual learning community for collaborative learning.
Multiple practices	The formative tests following after each unit in the story provide students multiple practices.
Reflection	The electronic notebook which was designed as a learning tool helps students reflect and take notes on what they are learning.
Technology	Hypermedia and network technology display learning materials to students.

2. A Test: A test was conducted to detect students' understanding on the concepts related to rainbow, humidity, and condensation. There were 23 items in the test which was validated and was examined its reliability (The Cronbach α= 0.76) before the formal experiment.
3. A questionnaire: A questionnaire with 34 Likert-type items was used to conduct students' opinions about the design of this web-based lesson. Four dimensions in the questionnaire were the opinions on interface designs, the designs of situations, the design of learning tools and the overall design of Lesson Rainbow. The Cronbach α of the questionnaire was reported as 0.87.
4. The follow-up interviews: A semi-structured interviews were conducted to investigate students' understanding of the relative concepts and to collected their opinions about the lesson. Twenty

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students (8 males and 12 female s) were selected for interviews based on specific purposes. Each student was interviewed for 20 - 30 minutes.

Procedure

This study includes three main stages: (1) The preparation stage (01/2000~11/2000): In this stage, the major work is to develop Lesson Rainbow and instruments. After pilot study, the instruments were validated and revised for the experimental stage. (2) The experimental stage (12/2000~1/2001): The pretest of the concepts was conducted in the week before the experiment. In the experiment, students received a training session for an hour and completed Lesson Rainbow in two hours. After a week of the experiment, the posttest of the concepts and the questionnaire were administrated. Then, the selected students received the follow-up interviews few weeks later because we needed to analyze data and found typical cases for the interviews. (3) The data analysis stage (1/2001~5/2001): Data analysis and concluding remarks were the major jobs in this stage.

Data Analysis

The data were analyzed in several ways. In order to examine if there was a significant difference between before and after treatments, the paired t-test was used to compare the pretest and posttest scores on concepts. A mixed design of repeated ANOVA was used to test the hypotheses stated male students and female students had a significant difference between before and after the experiment. We used descriptive statistics for the analysis of each item in the questionnaire and used Chi square to test if there was a significant difference among the four dimensions (the opinions on the interface designs, the design of situations, the design of learning tools and the overall design of Lesson Rainbow.) in the questionnaire. The collected data was analyzed using SPSS (Statistical Package for Social Science, version 7.0). The assumptions of normal distribution and homogeneity of variance for dependent variables were tested before applying statistic methods, t test and ANOVA. If the dependent variable is not a normal distribution, the significant level is reset to 0.04 in order to reduce Type I error (Stevens, 1996). Qualitative data were coded and summarized to show a deep understanding of students' learning processes and perspectives on Lesson Rainbow.

Results and Discussion

It was hypothesized that there is a significant difference between student pre and post concept tests. For Lesson Rainbow, the mean for the pretest was 16.7 with a standard deviation of 2.32. In contrast, the posttest mean was 17.4 with a standard deviation of 2.45. The result of repeated t-test showed that there was almost a significant difference (at a 0.04 significant level because of the abnormally-distributed scores of tests) between student pretest and posttests on concepts ($t = 1.98$, $p<0.051$; The data is shown in Table 2).

The pretest mean was 16.6 for male students and that for female students was 17.0. In contrast, the posttest mean for male students was 16.5 and that for female was 18.1 (The data is shown in Table 4). The result of mixed design of 2X2 ANOVA showed that there was a significant different between male and female students' performances on the pretest and posttest ($F=11.48$, $p<0.001$; The data is shown in Table 5). Few male students said that the animations in Lesson Rainbow were not as attractive as online games in interviews. Their low

attention on learning materials leaded to their low performances in the posttest. Computer logs also showed that less male students participated in the online discussion than female students did. This may reduce male students' knowledge construction. Both reasons made male students could not learn better than female students.

Table 2: Summary Table for Paired-t test

N=110	Mean	S.D.	t Value	P
Pretest	16.7	2.32	1.98	0.051
Posttest	17.4	2.45		

*p<0.04

Table 3: Descriptive Statistics

	Male(N= 49)		Female(N= 61)	
	Mean	S.D.	Mean	S.D.
Pretest	16.6	2.22	17.0	2.39
Posttest	16.5	2.55	18.1	2.14

Table 4: Summary Table for Two Way ANOVA

Sources	df	SS	MS	F	Sig
Before &After(A)	1	17.01	17.01	3.22	0.075
Gender(C)	1	63.11	63.11	11.48	0.001
Interaction(A* C)	1	15.79	15.79	2.99	0.087
Residual(A* S)	108	570.20	5.28		
Residual(C* S)	108	593.60	5.50		

*p<0.04; **p< 0.01

The data from interviewing the 20 students showed that most students thought the web-based lesson was more interesting than textbooks because of the animations and interactions. The online discussions made students feel more involved in the learning activities. Five of twenty students suggested that the teacher should participate in the online discussion with them because sometimes they did not know how to solve problems without the teacher's scaffolding. A student said in his interview: " *If the teacher could participate in the online discussion, it would increase the interactions and cleared confusions. I would learn better to have the teacher to involve in the online discussion.*" Different students have different needs in a web-based learning environment. Few of them need teachers' assistances because they are lack of skills on communication and reflective thinking. It is advised that the well-trained teachers involve in online communications with students in order to help weak students overcome their obstacles.

Conclusions

The focus of this study was on investigating the effect of a web-based lesson (Lesson Rainbow) developed to cultivate situated learning. The realistic situation served as a bridge to connect students' daily-life experiences and constructing knowledge. Most students had positive opinions about Lesson Rainbow. From interviews, some

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students said that animations for the simulation of authentic situations could promote their learning motivation and immerse them in an interesting context for meaningful learning.

Networked technologies support collaborative work in which the students combine components or work together making successive drafts (Wiske, 2000). Social learning theory emphasizes the value of dialogue and collaboration in helping students develop and articulate their understanding. In order to reach effective cooperation, students need to share ideas, adventure and argue with others so that they can come to reasonable interpretations of the subjects they are studying (Blumfnfeld, et al., 1997). Students can compare the varied views of a topic and enhance cohesive understanding of science from a well-designed online asynchronous discussion In this study, Lesson Rainbow succeeded in helping students knowledge integrating by evoking discussions for searching answers of the questions after realistic situations. When students communicate with others, they retrieve their pre-knowledge and reconstruct concepts. Meaningful learning occurs when students interact with others or environments (Savery & Duffy, 1995). Therefore, online asynchronous discussion designed for a situated learning environment can promote knowledge integration.

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Developing Guidelines for Effective On-line Collaboration

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Abstract: Increasingly, peer-to-peer collaboration is being used as an on-line instructional strategy. Unfortunately, creating an environment for collaboration over the web to occur doesn't just happen automatically. Many social and psychological barriers may present themselves. Collaboration on-line requires students to master unfamiliar technologies and ways of interacting. Furthermore, there are issues related to the lack of face-to-face contact. For example, the lack of nonverbal and social context cues (e.g., facial expressions and gestures) can hinder the development of trust. Group dynamics on-line are different, resulting in task groups taking longer to get oriented compared to face-to-face groups. Finally, a sense of social presence (for the instructor as well as students) is more difficult to establish and maintain when there is no face-to-face contact. While many papers suggest that one or more initial face-to-face meetings will improve collaboration, face-to-face meetings are not always possible or desirable. This leaves us with the need to address these issues in more creative ways. Our recent literature review provided some useful guidance on how instructors are adapting to the challenges of web-based collaboration. In an effort to gain a more complete understanding, we are posting a survey on the web that will question instructors about their collaboration facilitation strategies. Based on these results, we will develop a set of guidelines for effective use of on-line collaboration.

In the last few years, the Web has been increasingly used to not only share existing knowledge, but to create opportunities for knowledge generation through collaboration. Collaboration can occur asynchronously (for example, through e-mail) or synchronously using software packages known as "groupware." Groupware packages (e.g., Lotus Notes, Microsoft Exchange, Netscape Suite Spot, and Novell GroupWise) commonly include features such as conferencing, group decision support, meeting support, document sharing, bulletin boards, and chat that can foster direct interaction between individuals in a group. Group members can debate, engage in role-playing exercises, post questions and responses, or even compose collaborative documents in real-time.

These features have the potential to help manage and create intellectual assets by promoting the sharing and storing of ideas and expertise. Group collaboration has been used to promote learning in academia by exposing participants to alternative points of view in the context of problem solving. Conflicts between peers force them to defend their positions as well as seek additional clarifying information. In addition, the act of explaining has been shown to benefit both the more knowledgeable and the less knowledgeable peers (Webb, 1982, as cited in Hiltz, Coppola, Rotter, Turoff, & Benbunan-Fich, 2000). Not only can collaboration enhance learning, but it may also foster important social interactions, reduce the sense of alienation distance learners sometimes feel, and increase satisfaction with the learning experience (Hiltz &

Benbunan-Fich 1997; Irani, 1998; Clark, 2000). Hiltz et al. (2000) present evidence that while learning in isolation on-line is less motivating than learning in a traditional classroom, working collaboratively on-line leads to higher motivation than in a traditional classroom setting.

In contrast to cost-cutting "digital diploma mills," which require little interaction between students or between the students and the instructor, more educators are opting to create high quality on-line learning environments that embrace interaction, collaboration, and a supportive learning community (Hiltz, 1999). Unfortunately, creating an environment for collaboration to occur doesn't just happen automatically. First, considerable effort and skill on the part of the instructor is required. In addition, many social and psychological barriers may present themselves. Independent students, who may have self-selected into the distance learning format, may resist group collaboration. One hurdle is to get these students to buy into the idea. Another obstacle, which is relevant to many on-line learners, is that collaboration on-line requires them to master unfamiliar technologies and ways of interacting. Furthermore, there are issues related to the lack of face-to-face contact. For example, the lack of nonverbal and social context cues (e.g., facial expressions and gestures) can hinder the development of trust. Group dynamics on-line are different, resulting in task groups taking longer to get oriented compared to face-to-face groups. Finally, a sense of social presence (for the instructor as well as students) is more difficult to establish and maintain, when there is no face-to-face contact. While many papers suggest that one or more initial face-to-face meetings will expedite trust, familiarity, and a willingness to collaborate, one of the primary reasons why students engage in distance learning is the convenience of anytime, anyplace learning. Thus, face-to-face meetings are not always possible or desirable. This leaves us with the need to address these issues in more creative ways.

The Joint Advanced Distributed Learning (ADL) Co-lab, which supports the implementation of ADL within the military, is coordinating with the research and development and academic communities in order to identify the best practices in on-line learning. Collaborative, asynchronous learning is seen as a promising approach for training military teams, who must work collectively, despite the fact that they are often distributed geographically. A recent paper (Hughes, Wickersham, Ryan-Jones, and Smith, in press) by members of Joint ADL Co-lab reviewed the literature, finding that for on-line collaboration to be most successful, participants must: (1) see the value of expending the (considerable) effort required, (2) be comfortable with and trusting of the medium, (3) be comfortable with and trusting of their instructor (or facilitator) and their fellow collaborators, and (4) feel as though they are immersed in a rich, engaging, and rewarding social experience.

The literature review produced some good clues as to how to address these issues. Instructors working on-line have been adapting to these requirements in a variety of practical and innovative ways. For example, most instructors provide some sort of orientation training to students. The content of this training varies widely. It may include an assessment of each student's technical ability, so that the instructor gets a good idea of who will need the most technical help. Some instructors discuss "netiquette," the social conventions associated with on-line interactions. Others may include ice breaker activities such as informal social web conferences or group based on-line games. Another approach some instructors have taken is to have students introduce themselves to others in the group by posting biographical sketches of themselves.

We have a sense that many instructors teaching on-line are probably addressing the challenges of web-based collaboration in idiosyncratic and innovative ways, but not necessarily publishing their practices. Thus, a substantial amount of useful information may be slipping between the cracks. We want to gain a more complete understanding of what instructors are doing to facilitate on-line collaboration. Furthermore, we want to encourage the sharing of these practices and ideas. In order to collect more detailed information about what instructors are doing to facilitate collaboration in their on-line courses, we have developed a survey, which will be posted on http://www.jointadlcolab.org. Based on the data we collect with this survey, we will develop a set of guidelines for how to most effectively use collaboration as part of an on-line instructional strategy. This resource will be posted on the web site and will be available for civilian as well as military instructors.

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The Impact of Information and Communication Technology (ICT) on Job Characteristics of South African University Academics

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A study was recently carried out on the use of Information and Communication Technology (ICT) by South African University Academics. The impact of ICT on job characteristics of academics - teaching, research and to a lesser extent, administrative duties was investigated. Academics at the University of Fort Hare, South Africa's oldest and first historically black institution (HBI) were tested in this exercise. Realizing that South Africa's HBIs exhibit a lot of commonalties in structure, operation and management, no doubt, this study strongly reflects the general situation with this country's HBIs. Academics across all disciplines and hierarchy were included in this questionnaire survey supplemented by interviews. Results indicate an established need for ICTs, a general lack of adequate computer facilities, low level of computer literacy among academics, a need for training in ICTs, high level of unreliability in networking allowing access to the use of the INTERNET, and the non-existence of ICT policies for computer equipment upgrades, hardware and software purchases and training. Albeit, it was evident from the study that academics with adequate knowledge of the use and application of ICT in their jobs did record significant improvement in the discharge of duties.

Retrieval System of On-Line Kanji Dictionary with Learning Functions

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Abstract: In this paper, the authors have attempted to develop a useful system in retrieving Kanji. It will be terribly difficult for non-Japanese people to master Kanji because Kanji characters are over 2000 and their shapes have much complexity. Especially it is hard to retrieve Kanji with a conventional dictionary. Even if the user does not know any of Reading, the total number of Strokes, Radical, this system allows people to look up Kanji characters easily by only selecting its simple peculiarity such as the number of vertical lines, a number of horizontal lines and some parameters. This system works effectively by just only mouse click when someone encounters an unfamiliar Kanji character. This system consists of the client and the server. The database of this system is updated when the user retrieves a certain Kanji. For that update, this on-line dictionary will become more useful.

1.Introduction

In this research, the author has constructed a Electronic Kanji Retrieval System which enables the user to look up Kanji characters easily only by mouse click even if the user has little knowledge about Kanji. The quantity of Kanji is over 2000 and the shapes are complicated. It is very difficult to look up Kanji characters in a conventional dictionary when people in the countries where Kanji characters are not used have met an unfamiliar Kanji on the newspaper. The author will use the term Non-Kanji-User as people in the countries where Kanji are not used. It is necessary to know any of Pronunciation, Total strokes or Radical (the special element which composes Kanji) to look up Kanji characters. However, they often cannot specify this information correctly. We know another retrieval system, which enables the user to look up Kanji characters from parts of Kanji[1]. For example, when people retrieve Kanji 春, they can retrieve it from 三, 人, and 日. This retrieval method would be effective for the Japanese. However, it is not easy for Non-Kanji-User to use this method, since foreigners will have difficulty to find an individual Kanji which composes the Kanji. Then, we have developed a quite new, epoch-making method. This method enables people to retrieve Kanji by selecting the number of vertical lines, the number of horizontal lines of Kanji, the presence of the point, etc. Furthermore, this system has the learning functions and copes with a difference of an individual sense. This system consists of the client and the server. And the database is put on the server side. The database on the server is updated in accordance with an input of the user. This system takes account of commonly selected parameters and comes to show proper Kanji characters in higher rank by updating the database.

2.System Configuration

http://www.narita.elec.waseda.ac.jp/~iida/kanji/retrieval/index.html

2-1. Advantages

Even if the user does not know any of Total Strokes, Reading and Radical, people will look up a Kanji characters easily with only mouse. The Kanji that the user wants will be displayed in the high rank even if the input parameters are different from models a little. This system is different from a conventional dictionary and it enables the user to check meanings, idioms, pronunciations, and animations that show its structure with multimedia technologies. From reason mentioned above, it is possible to use this system as the integrated study dictionary.

2-2.Procedure

The user inputs six parameters of Kanji he/she wants to look up. The definition of Parameters is given in Chapter2-3 below. These parameters are compared with models set in each Kanji. These models have been set beforehand as value the most people seem to select. Five Kanji characters that have a strong possibility are displayed in the browser. The user clicks a most pertinent Kanji. The following five Kanji characters that have strong possibility are displayed by click a NEXT button when a pertinent Kanji is not displayed. Information of the selected Kanji is

drawn out from the database, and it will be displayed in the browser. The model in the database is updated in accordance with the parameter.

2-3. Parameters

The following six parameters have been adopted. A: The number of vertical lines. B: The number of horizontal lines. C: The number of slash lines. D: The number of penetrated points. E: The existence of closed space. F: The existence of point. For instance, in the case of 村 A=2, B=2, C=2, D=2, E=0, F=1 村 does not have any closed space. So we show you another example (Fig.1). That has a closed space.

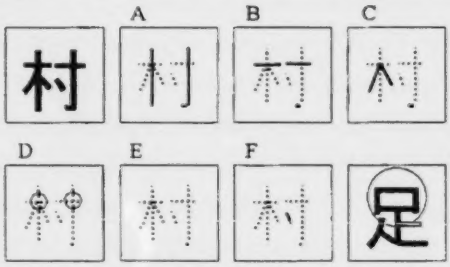

Fig. 1 parameters

2-4.Retrieval methods and Display of data

The Kanji is retrieved in accordance with the input. The following items were registered in the database. They are Kanji, Readings, Meanings, Radicals, Strokes, Examples, Animation files, Sound files and models about each of Kanji. We registered six parameters as models in advance. This system retrieves Kanji by comparing these parameters with models. This system makes proper Kanji displayed if many parameters are the same as models. The question now arises: some people may consider that there are three vertical lines and others may consider two. For instance, about 川 some people may regard a left part as a vertical line and others may regard it as slash. Using the update of the database solves such an individual difference. Concretely, the model of vertical line of 川 is three. When a user inputs a vertical line number as two, the value of the model that corresponds to two goes up gradually. When some inputs are different from models, the models in database will be updated in accordance with the each input. Five Kanji characters are displayed in order with high total point after the total point is calculated to each Kanji. When the user will choose most pertinent Kanji that is displayed in a Browser, the button of meanings, examples, Animations that show its structure is displayed in the browser. In giving the above-mentioned operation, even if the input is different from the models registered in the beginning, the total point goes up and Kanji which the user wants is displayed preferentially. That is to say, if a lot of people select a Kanji displayed as the second Kanji in the beginning, it comes to be displayed as the most pertinent Kanji. The Japanese language beginner will retrieve Kanji the user wants more easily.

3.Conclusion

In this paper, we described the Epoch-making method of Kanji-English dictionary. This system enables the user to looked up the meaning of an unfamiliar Kanji even if the user did not have detailed knowledge about Kanji. A lot of foreign students come to Japan to learn Japanese language. They need Kanji dictionary for not Japanese but them. Our system has provided foreigners with opportunities to learn Japanese by themselves. We are convinced that this system will work effectively for them.

4.Future work

After we will bring the evaluation of this system, we will improve this system in the light of advice from teachers and students. Now Shockwave Plug-in is needed to use this system. We will advance a development with Java because Java can achieve the multi platform use. We will develop PDA version of this system as soon as possible. PDA will enable the user to look up Kanji in town.

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The Internet And Africa From A Sub – Saharan Perspective

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Owing to this my paper will try to focus on the impact of the Internet and Africa from a sub – Saharan perspective, my reason for this is based on my field of experience in this sub – continent of Africa both as a computer lecturer, educator and information technology consultant. Talking about communication in general first and fore most in Africa it is a very sorry state, either be it road communication, air communication, rail or even sea communication or telecommunication, the word communication in the whole of Africa at large has become related with the word problem. Hence it is not surprising that with the coming of the Internet in Africa which relies heavily on one form of digital communication or the other a great deal of work has to be placed for this now important aspect of communication to take place with out any loops holes.

A Web-Based Distance Learning System to Support Professional Training for Librarians

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Abstract: This paper presents a WWW-based distance learning system to support professional training for librarians and its initial evaluation. The system is taking place of a current training course that our institute offers to university libraries nationwide. The course offered by the system is about a system to support inter-library loan service, and is made up of multimedia information such as narration and animation. The course features: 1) Repetitive and clear presentation of current location of a learner 2) A simulator to learn operation of a system 3) Learning modes that support stepwise learning. The initial evaluation by questionnaire showed good acceptance of the system on the whole.

Introduction

The importance of education has been recognized anew globally. G8 Summit at Köln in June 1999 and G8 Education Ministers' Meeting at Tokyo in April 2000 were symbolic events. There the importance of lifelong learning and the importance of using information and communications technology in education were reconfirmed (G8 99)(G8 00). Research on distance learning has been active with the development and growth of information and communications technology, typically the Internet, WWW, and low-priced PCs. The circumstances are the same in Japan, but a great part has directed to elementary and secondary education. Some of the initiatives to elementary and secondary education were the 100-School Networking Project, the E square Project (Center for Educational Computing 99), and the "infomationization" of education in the millennium project(Prime Minister of Japan 99). The research and deployment of distance learning in other educational categories such as higher education and professional education are themes from now on. The higher education council organized by the Ministry of education, science, sports and culture (now the Ministry of education, culture, sports, science and technology) pointed out the importance of the provision of distance learning environment using information and communications technology (Monbusho 00). We have been conducting a research project of distance learning under those circumstances (Inoue 00).

This paper deals with a web-based distance learning system to support professional training for librarians and its initial evaluation. It is a practical research that uses an existing professional training. Also it is a project that shifts a training course in a room to a distance learning setting. Such a case will be increasing as distance learning becomes widely accepted.

The initial evaluation resulted in good acceptance of the system and the course on the whole. We could have a prospect that a use of distance learning to this type of professional training is possible through this case. Also we had many comments on our distance learning service.

An inter-library loan system and its training course are presented in the next section. Then a web-based distance learning system and its course are explained, followed by its initial evaluation.

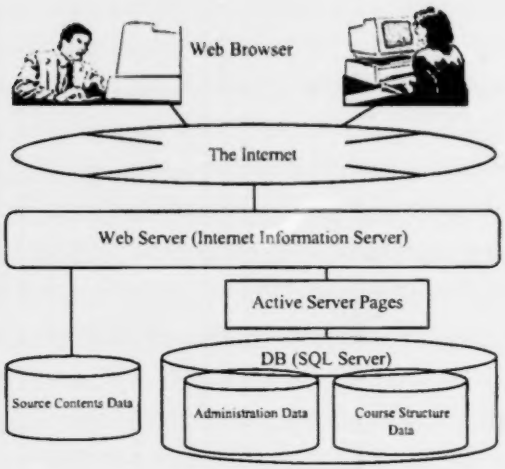

Figure1: System structure

Chapter	Contents
1	Overview
2	Catalog search
3	Copy operation
4	Loan operation
5	Request cancellation
6	Declination of a request
7	Inquiry of a request
8	Inquiry of requested documents
9	Request by reference files
10	Request without bibliographic record
11	Request to NDL or BLDSC
12	Participating organization files
13	Other operations
14	Appendix

Table 1: Table of the contents

Training Course of the Inter-Library Loan System

Our institute gathers, organizes and provides scholarly information and relevant systems nationwide. One of the tasks is catalog information service. The inter-library loan system is used to provide a part of the service. It supports to manage exchange of information that is needed when academic documents are exchanged between university libraries.

We have conducted a training course of the inter-library loan system, which offers lecture and practical training of the system to librarians. Current training course is 2-day course in a room Thus time and places for holding is limited. As a result, less than 60% of those who would like to take the course have been allowed. Booking a number of lecturers has been also a problem.

Web-Based Course of the Inter-Library Loan System

A web-based distance learning system has been developed to offer opportunity of the training widely. It is a self-paced learning system based on a commercial product. It has three-tier structure that uses a Web browser, Internet Information Server and Active Server Pages for the Web server, and SQL Server for the data base. The data base stores administration data and course structure data. The source contents are stored as HTML files, and are linked from the course structure data. The Active Server Pages script files control the system (Fig. 1).

The web-based course of the inter-library loan system succeeds the current training course in its contents. A textbook of the training course that has been revised many times so far is used as a base of the web-based course. The web-based course has the table of contents and has the structure of chapters, sections, and subsections. From the table of the contents, the chapters and the subsections are linked to the corresponding pages that enables users choose a specific topic directly. The contents are shown in (Tab. 1). Yet the course is enhanced by animation, video, and audio.

To learn the operation of the inter-library loan system is a major part of the training course. To know the whole figure of a job in advance is helpful when learning steps within. The course shows task flows and explains them before going into smaller steps. Specifically a whole figure of a job is shown and is explained in the beginning of a chapter, because typically a chapter corresponds to a job. Then a page such as (Fig. 2) is shown in the beginning of each section. Here the figure on the right is the same as presented in the beginning of a chapter. More detailed explanation for a procedure, which is a part of a job, is given in a section. In the figure, a procedure to be explained is a highlighted arrow on the right. The procedure is represented as a sequence of tasks, which are shown on the left, and is explained step by step with animation and narration. A learner is able to locate himself/herself in a way of learning because of this clear and repetitive presentation of whole figure.

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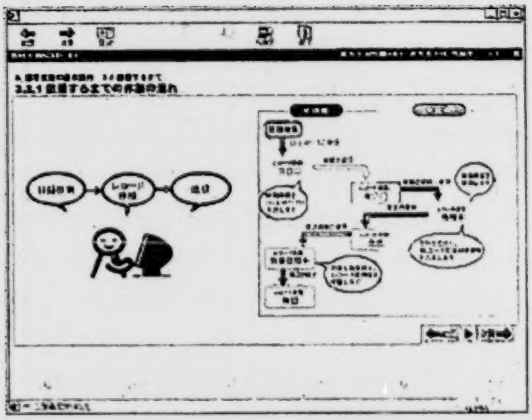

Figure 2: Explanation using a task flow

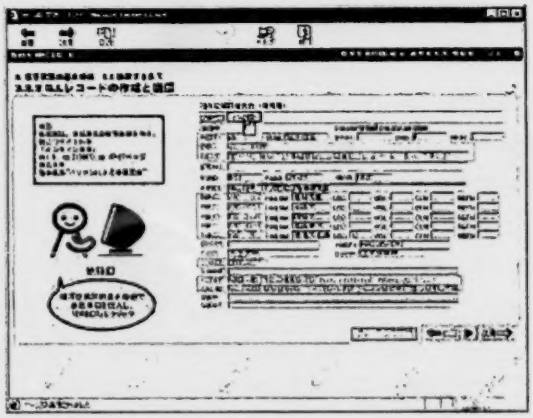

Figure 3: Instruction in the lecture mode

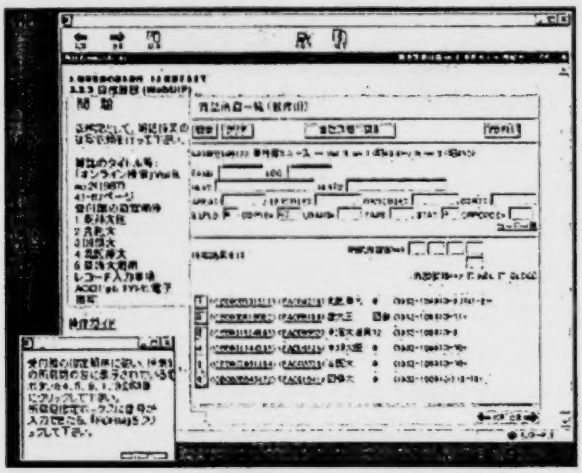

Figure 4: Instruction in the guided mode

The course has three modes of learning, which are lecture mode, guided mode, and practice mode. In the lecture mode, the objective and outline of each chapter is explained. The operation is instructed by animation and narration. A learner learns passively in this mode. (Fig. 3) is an example. An exercise is given in the upper left. On the right is a screen of the inter-library loan system that shows the answer operation by animation. The instruction is presented on the bottom left by text and narration. The lecture mode is followed by the guided mode and the practice mode in the sections to learn operations of the system. In these modes, a learner can practice several exercises including the ones that are presented in the lecture mode by using a simulator of the inter-library loan system. The use of the simulator corresponds to a practice that uses the inter-library loan system in the current training course. (Fig. 4) is an example of the guided mode. An exercise is given in the upper left. The simulator that is on the right allows operations such as input to the blanks from a keyboard, selection of options, and putting the buttons. The screen changes to the next screen by the correct operation to the simulator. An error message window that prompts another try pops up by the wrong operation. Clicking "the operation guide" button on the bottom left calls the guidance window.This interactive environment is intended to give a learner a real learning experience. The guided mode is the same with the practice mode with the guidance window in implementation. Typically a learner begins a exercise without guidance first. When he/she is stuck on the way of the operation, he/she may call the guidance window and follows the instruction there to complete the operation. Each learning mode is intended to relate closely so a learner can progress gradually by himself/herself.

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Pre test and post test are placed at the beginning and at the end of the course to assess learner's achievement by the course. The course also has exercises that are located at the end of each chapter and an comprehensive examination that is located at the end of the course. They have marking function.

Initial Evaluation

Initial evaluation of the system was conducted. Total of 34 subjects (10 men and 24 women) from 19 university libraries participated as a learner. This section describes the result as well as the improvement afterwards.

Method

The subjects filled out a web-based questionnaire after use of the system. The number of the items of the questionnaire was 15 including affiliation, name, the sections of the course you went through. Other 12 items are shown in the left side of (Tab. 2). Both structured questions that used five-point Likert-like scale and open-ended questions were applied to the questions about usability and the course.

Two thirds of the subjects went through the whole course, and most of the subjects went through more than a few chapters. The subjects were classified in terms of experience of the inter-library loan system. Majority of those had experience over a year, while rest of those were novices. Appraisal by experienced users was considered to be useful because they knew what was important for actual work and what should be learned in the course. Appraisal by novices was useful as well because they were the prospective users of the system.

Usability

"Mouse-base usability" concerns clicking operation by a mouse to move between pages. "Good" and "Neutral" were most selected. Some users would like to use short keys for buttons.

"Good" was most selected in "Narrative explanation." Repeating from the start was the only function to listen to the narration in a page. There were requests for a function to stop at and repeat from any part of the narration. A stop button was added to each page then. There was a comment that it might be a case that a course with sound like this was undesirable when used in actual work environment. We thought this was worth listening. Its situation of use should be considered when designing a course. Design of a course is not closed within the course.

"Very good" was most selected in "GUI appearance understandability." There was a comment that a repeat button of narration was not easy to find. It was a triangular icon between two arrow icons for the previous page and the next page.

"Neutral" was most selected and "Long" was also selected by several subjects in "Duration before narration." It seemed to depend much on the network conditions.

Contents of the Course

Time required

"Less than 3 hours," the shortest choice, was most selected in the "Time required for the course." It was the same as in the "Average time required for a chapter." "Less than 0.5 hours" was most selected. Wide range of choices was prepared considering that the current training course use 2 days. However more useful result might be gained if there were choices in shorter range. The relation between "inter-library loan experience" and the "time required for the course" in (Tab. 3) shows that experienced subjects tended to use shorter time than novices. Yet even novices use much shorter time than 2 days. It is known that self-paced CAI system such as this decreases learning time compared to class lecture (Yamamoto 97), although the biggest reason of the result is supposed that this use was not for actual learning but for evaluation of the system. Additionally, the net time required for the course, the time only for listening the narration once that does not take network conditions into account, is shown in (Tab. 4).

Inter-library loan system experience	None	Less than 3 months	Less than 6 months	Less than a year	More than a year
	8	1	1	2	22
Time required for the course	Less than 3 hours	Less than 6 hours	Less than 12 hours	Less than 18 hours	More than 18 hours
	23	10	1	0	0
Time required for a chapter	Less than 0.5 hours	Less than 1 hours	Less than 1.5 hours	Less than 2 hours	More than 2 hours
	25	8	1	1	0
Mouse-base usability	Very good	Good	Neutral	Poor	Very poor
	7	14	12	1	0
Narrative explanation	Very good	Good	Neutral	Poor	Very poor
	10	15	7	1	1
GUI appearance understandability	Very good	Good	Neutral	Poor	Very poor
	16	3	5	0	0
Duration before narration	Very short	Short	Neutral	Long	Very long
	0	2	18	8	6
Difficulty of the contents	Very difficult	Difficult	Neutral	Easy	Very easy
	0	1	31	2	0
Difficulty of the expression	Very difficult	Difficult	Neutral	Easy	Very easy
	0	2	32	0	0
Difficulty of pre/post test	Very difficult	Difficult	Neutral	Easy	Very easy
	1	2	31	0	0
Difficulty of exercises	Very difficult	Difficult	Neutral	Easy	Very easy
	0	1	30	3	0
Difficulty of comprehensive examination	Very difficult	Difficult	Neutral	Easy	Very easy
	0	1	31	2	0

Table 2: Result of the questionnaire

Time required for the course	Inter-library loan system experience: None	Inter-library loan system experience: More than a year
Less than 3 hours	4	16
Less than 6 hours	3	6
Less than 12 hours	1	0

Table 3: Relation between inter-library loan system experience and time required for the course

Chapter	Time (sec.)
0 (Start page)	25.4
1	585.1
2	428.0
3	670.6
4	819.6
5	229.7
6	227.9
7	315.4
8	314.5
9	160.2
10	138.7
11	665.1
12	139.2
13	228.3
14 (Appendix)	N/A
Total	4947.7

Table 4: Minimum time required

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Difficulty

"Neutral" was most selected in each of "Difficulty of the contents," "Difficulty of the expression," and "Difficulty of the examination." Succession of the contents from the current training course was highly appraised. The task flows were evaluated highly as useful for understanding. In the each job of inter-library loan, a learner could be the one who send a request or the one who receive a request. We had a comment that a novice was often confused by the nature that was essential for an exchange. So we changed the background color according to the sender's side or the recipient side of a request to make the distinction clearer. It also appreciated. The examination was evaluated affirmatively on the one hand in that a learner could realize his or her own understanding. On the other hand, it was demanded to change to show explanation to the result and to show the referential part of the course.

Conclusion

Distance learning, which is getting popular, does not mean to make a big gap between conventional education in terms of the things learned. It is more likely that the contents do not change even if the form or the expression of the contents changes. This is applicable to the research presented in this paper. We explained how we had been changing our professional training course into the form of web-based learning. Development of the web-based distance learning system was carefully conducted especially in its course design. Specifically we applied a few ideas that would help learners master the contents easier. They were repetitive and clear presentation of the current location in a whole procedure, the use of a simulator of the actual system, and the application of stepwise learning modes. The course design was not totally new, but was improved substantially based on the current training course and its textbook. The course produced through such a procedure was not surprisingly fantastic, but was easy to accept for the users. It is thought to be one of the reasons that the contents of the course gained good evaluation.

From the result of the initial evaluation, we could conclude that web-based distance learning is a realistic solution to make professional training like this widely available. Besides, we could get many comments. Some of them clarified a couple of important points that should be considered when providing distance learning services. One thing was that it was currently necessary to take the network conditions into account. Those who selected "Very long" in "Duration before narration" also mentioned that point. It showed that it was important not to wait. The other was that a learner felt the course monotonous when he or she takes it continually. Long-time continuous use was often seen because the use was for evaluation this time. However it would be applicable generally. Because it is different from something that could be solved by using multimedia, it is desirable for example to give opportunities to suspend learning in the course.

Although the subject of this research is professional training of the inter-library loan system, the course elements employed in this research such as a task flow, a simulator, and a learning mode could be applied to a similar course that contains routine operations. This type of training course is presumed to be fairly common.

Acknowledgments

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What is a learning object, technically?

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Abstract After analysing the reuse of learning resources from different pedagogical paradigms, this paper argues that there is an obvious gap between the learning technology community and the education community. The terms "learning resource" or "learning object" are not native to the education community. The education community is not interested in issues of reuse, grain size, technical properties or even "learning object". This paper suggests that a way forward is to have a clear demarcation of responsibility between learning technologist, subject matter experts and instructional designers.

Introduction

Wiley (2000) noted that there was confusion with the notions associated with the term "learning object". Ip, as cited in Quinn (2000), expressing the frustration said that he was *"still struggling with an operational definition of a learning object".*

Current Views

The IEEE Learning Technology Standards Committee (LTSC) defin es a learning object as *"any entity, digital or non-digital, that can be used, re-used or referenced during technology supported learning"* (LSTC, 2000). This is extraordinarily broad. This definition implies learning objects can be documents or software components provided they can be of value in a technology supported learning environment. A more defined view was expressed by Frank Farance at the LTSC meeting (on10th August, 1999) where he described learning objects as the result of the association of learning assets (reusable learning resources) with LOM (learning object metadata). He made the point that a learning object is not an object as defined in object oriented programming.

There are other definitions as well. Computer-based training (CBT) vendor NETg, Inc., uses the term "learning object" but applies a three-part definition: a learning objective, a unit of instruction that teaches the objective, and a unit of assessment that measures the objective. (L'Allier, 1998) NETg's definition limit s learning object to be passive "reading material" type resource (excluding t he possibility that learning object may be interactive requiring computational support). NETg further limits learning object to a special class of resource. Ip, as cited in Quinn (2000), taking input from Lian and Schuyler, suggests that an learning object must have at least 4 sub-components: content, functions, learning objectives and 'look and feel'. Another CBT vendor, Asymetrix, defines learning objects in terms of programming characteristics: "ToolBook II learning objects - pre-scripted elements that simplify programming ... provide instantaneous programming power". (Asymetrix, 2000) The NSF-funded Educational Objects Economy takes a technical approach, only accepting Java Applets as learning objects. (EOE, 2000) It would seem that there are almost as many definitions of the term as there are people employing it.

In addition to the various definitions of the term "learning object," other terms that imply the general intention to take an object-oriented approach to computer-assisted instruction confuse the issue further. SCORM [SCORM, 2001 #205] use the term "content object". David Merrill uses the term "knowledge objects" (Merrill, Li, & Jones, 1991). Merrill is also writing a book on the topic of object-oriented approaches to instruction to be called "Components of Instruction" (Wiley, 2000), which is sure to introduce yet another term: "instructional component". The ARIADNE project uses the term "pedagogical documents" (ARIADNE, 1999). The NSF-funded Educational Software Components of Tomorrow (ESCOT, 2001) project uses the term "educational software components". The Multimedia Educational Resource for Learning and On-Line Teachin g (MERLOT) project refers to them as "online learning materials" (MERLOT, 2000). The Apple Learning Interchange simply refers to them as "resources" (ALI, 2000). Finally, Ip used the term "virtual apparatus" to refer to independent educational components which can be combined on a web-page to produce educationally interesting learning. (Ip & Canale, 1996; Ip, Canale, Fritze, & Ji, 1997; Ip & Canale, 1997b; Fritze & Ip, 1998).

On the other hand, there is no reference to the term "learning object" at all in the IMS Content Packaging specification (v1.1) (Young & Riley, 2000).

Metaphor Used

Many authors (e.g. Mason, Adcock & Ip, 2000) have used the metaphor of LEGO building blocks to describe Learning Objects. The LEGO metaphor conveys the notion of *"small pieces of instruction (the LEGO blocks) that can be assembled (stacked together) into some larger instructional structure (castle or spaceship)."* (Wiley, 1999). Wiley expressed his reservation of the LEGO metaphor as he observed that a random combination of learning objects may not necessarily produce instructionally-sound course material and not all learning objects can be combined together. Wiley, Gibbons, &

Recker (2000) further introduce the notion of "atoms" as a metaphor because while atoms are the smallest units under chemical combination laws, not all atoms can be combined to produce molecules.

Granularity

The appropriate size of learning object has been another issue addressed by researchers (Quinn, 2000). As stated above, the Learning Technology Standards Committee's definition leaves room for an entire curriculum to be viewed as a learning object, but such a large object view diminishes the possibility of learning object reuse. Wiley et al.(2000) cite an architectural metaphor originally developed by Brand (1994) to shed some light on the issue. This 6-S sequence consists of

- SITE – The physical location that is there forever;
- STRUCTURE – The building foundation and load-bearing elements which lasts the life of the building.
- SKIN – Exterior surfaces redesigned every 20 years or so.
- SERVICES – These include plumbing, communications, electrical wiring, etc. and are replaced every 7 to 15 years.
- SPACE PLAN – The interior layout can change every 3 years or so.
- STUFF – Furniture and equipment can be changes around daily to monthly.

He notes that good design must allow 'slippage' between the layers so that they can be renewed at the end of their lifespan without destroying the entire structure. Based on this layered concept, Wiley et al. (2000) mapped these characteristics into their description of a learning object as Model, Problem, Strategy, Message, Representation and Media. He argued that while these are independent layers, they may be "compressed" into the learning object. The level of granularity could be analysed by counting the number of layers that were present in the learning object. However due to the potential different rate of the aging of different layers, the more layers are compressed into the learning object, the less robust the learning object may be.

While using different terminology and referring to different semantic systems, Wiley and the IMS Content specification both promote the layered approach. The IMS Content Package specification version 1.1 (Young & Riley, 2000) defines the Package Interchange File is a single file, (e.g., .zip, .jar, .cab) which includes a top-level manifest file and all other physical files as identified by the manifest. A Package Interchange File is a concise Web delivery format, a means of transporting related, structured information. Hence a package represents a unit of usable (and reusable) content. This may be part of a course that has instructional relevance outside of its course structure and can be delivered independently, as an entire course or as a collect ion of courses. The mandatory manifest is a description in XML of the resources comprising meaningful instruction. The resources described in the manifest are physical assets such as web pages, media files, text files, assessment objects or other pieces of data in file form. Resources may also include assets that are outside the package but available through an URL, or collections of resources described by sub-manifests. IMS has deliberately avoided the notion of learning objects and uses the term 'resources'.

Use of Resources In Different Pedagogical Paradigms

Pedagogical paradigms selected here do not form an exhaustive list of contemporary pedagogical frameworks. Rather, they provide indications of the width and breadth of the technical issues as we attempt to understand the issues of reusing learning object s in virtual learning environment design.

Tutorial, Drill and Practice

At one end is "drill and practice". At the other end, a tutorial environment provides a mechanism for presenting a problem to the online learners and provides feedback depending on the answer. When appropriately designed, the feedback mechanism can support Laurillard conversation model of higher learning (Laurillard, 1998).

A reusable unit may be an item (consists of the stem which is the question and responses, feedback and scoring information). IMS Question and Testing Interoperability (IMS QTI) specification (Smythe & Shepherd, 2001) is a good candidate for encoding learning resources for reuse in this paradigm. It is designed to support question and test interoperability between different authors, publishers and other corresponding content developers.

Learning engine (Fritze & Ip, 1998; Fritze & McTigue, 1997) is a richer environment for drill and practice by allowing learners to interact with input/output and visualization device. The learner may response to an item by drawing on a graphing device instead of selecting any pre-drawn graphs. The reusable component is both the resource which determines the graph and the software component which acts as the input/output and visualization device. Another software component, Text Analyzing Object (TAO) (Kennedy, Ip, Adams, & Eizenberg, 1999; Kennedy, Ip, Eizenberg, & Adams, 1998) is also a reusable unit which requires software to use and interpret the resource.

Case Method

A teaching case is a story describing, or based on, actual events, that justifies careful study and analysis by students. In other words, a teaching case is a story about the "real world" told with a definite teaching purpose in mind. A teaching case is a way of bringing the real world into a classroom so that students can "practice" on actual or realistic problems under the guidance of their teacher. Case teaching, unlike conventional lecturing, is discussion-based and experiential. The teaching case replaces the lecture as the vehicle for learning, and the case becomes the basis for discussion, exchange of ideas, knowledge and experience among participants (Lynn, 1996; Rangan, 1995).

The case method has been practiced in the United States for many decades. It was made famous, first, by Harvard University's Business School and, later, by Harvard University's John F. Kennedy School of Government. Now cases are widely available from these two schools as well as via the World Wide Web from other sources. Obviously, the learning resources are the teaching cases together with all the discussion questions, teaching guide associated with the cases. Proper metadata tagging will promote the discovery of appropriate cases for specific learning situation and themes.

Goal-based learning

Goal-based scenarios (GBS) are essentially simulations in which there is a problem to resolve, or a mission to complete. They require learners to assume the main role in the resolution of the problem or the pursuit of their mission (Schank, 1997; Schank, 1990). Hence, goals in this context refer to the successful completion of t he task at hand, and not the achievement of grades. Much of the information and knowledge that is required to achieve this goal

is available in the form of video clips with a talking head telling a story from the prospective of practitioners (see Schank & Cleary, 1995). A GBS serves both, to motivate learners and also provide them with the opportunity to learn by doing, by making mistakes, and receiving feedback.

The description of the scenario is obviously a resource that may be reused in other paradigm such as case method. The major challenge in creating GBS is the just-in-time requirement of providing the learners with appropriate resources. This will imply sophisticated metadata tagging in order for the goal-based learning system to locate relevant learning objects efficiently.

In this paradigm, the learning architecture needs to store the learner profile or previous activities in order to advance to different stages of the scenarios as well as providing the just-in-time resources.

Learning by designing

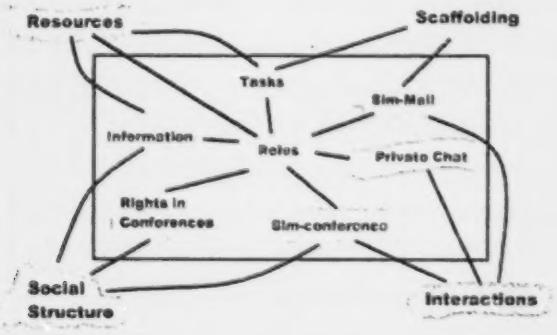
This is an educational context in which the core learning activity is the design of an artifact. Designing as a means for acquiring content knowledge is commonly used in practice-based disciplines such as engineering and architecture (Newsletter, 2000; Hmelo, Holton, & Kolodner, 2000). The obvious benefit of a design task is its inherent situatedness or authenticity. In design-based learning activities, students' understanding is "enacted" through the physical process of conceptualizing and producing something.

When students are creating artifact (digital or otherwise), the learning architecture needs to be able to track the artifacts by automatically applying either embedded or detached metadata for the artifacts. Tanimoto proposed a framework for Distributed Transcripts for Online Learning (Tanimoto, 2001)

Learning objects created by the instructor may not be critical for reuse purposes. The student created artifact may be a source for examples in future run of the course and hence there is reuse value when captured appropriately.

Web-based role-play simulation

Role-play simulations are learning situations in which learners take on the role-profiles of specific characters in a contrived educational game. (Linser, Naidu, & Ip, 1999) As a result of playing out roles in a role play simulation, learners are expected to acquire the intended learning outcomes as well as make learning enjoyable. While the underlying belief of web-based role play simulation is similar to goal-based scenario, it differs in both the dynamic nature of the goals during the process as well as the mechanism in supporting learning.



Among other things, stories or cases are used to create an authenticate scenarios. However, other resources, such as specific information provided to different roles to create the information gap among roles, may be specific to this learning environment. Of special interest is the use of real time news (NEF resources (Ip, Morrison, Currie, & Mason, 2000)) or other forms of resources originally created NOT for educational uses. These NEF resources may play an important part in enriching the learning experience. The learning architecture needs to support interchange of information among the learners, especially bi-directional communication capability.

Distributed problem-based learning

Problem-based learning (PBL) is an instructional approach that exemplifies authentic learning and emphasizes solving problems in rich contexts. It uses an instructional problem as the principle vehicle. The analysis and study of this problem comprises several phases that are spread over periods of group work and individual study (Barrows & Tamblyn, 1980; Schmidt, 1983; Evensen & Hmelo, 2000). A typical environment (e.g. Liu, Williams, & Pedersen, 1999) that based on PDL will:

(1) Situate the problem in a rich context and allowing learners to engage in scientific inquiries as experts do;
(2) Present the problem with its complexity, yet providing tools to support students in working with complexity;
(3) Provide information in multimedia formats to allow dynamic and interactive presentations that address different learning styles and student needs;
(4) Provide experts' guidance from multiple perspectives to facilitate knowledge acquisition and transfer; and
(5) Emphasize the interrelated nature of knowledge.

Distributed problem-based learning refers to the use of this strategy in a networked computer-supported collaborative environment where face-to-face communication among participants is not essential.

Problems, as learning objects, are resources with specific learning objectives. However, such learning objects would need to be richly linked to other learning objects in order to create the rich context for the problem to have the complexity and authenticity for learners to fully engage in this paradigm. Like web-based role-play simulation, this paradigm requires collaboration support from learning architecture. Unlike web-based role play simulation, most of the current online generic conference features found in LMS will meet the need of this pedagogical design.

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Critical incident-based computer supported learning

There has been growing interest in building learning environments that focus on supporting groups of learners engaged in reflection on critical incidents from their workplace (Wilson, 1996). A critical incident (from the workplace) presents a learner with a learning opportunity to reflect in and on action. Learners can do this by keeping learning logs which is a record of learning opportunities presented. The critical attribute of the learning log is that it concentrates on the process of learning. It is not a diary of events nor is it a record of work undertaken, rather it is a personal record of the occasions when learning occurred or could have occurred. The learning log also relates prior learning to current practice and is retrospective and reactive in action.

The learning architecture needs to support distributed management of learning logs. Most computer supported collaboration environment would be sufficient to support this type of learning.

Rule-based simulation

Microworlds, or computer simulations of restricted environments, are an intuitively appealing way to promote discovery and exploratory learning. Papert (Papert, 1980) called computer supported microworlds "incubators for knowledge" when he described the potential of computer aided learning to encourage exploration and thus self-education by children. His educational philosophies stem from Piaget's work on learning which, simplistically, state that much of children's learning occurs without being taught: children construct their skills and understanding from seeds of knowledge.

Creation of digital microworld for simulation and learning may be one of the most challenging and creative aspect of designing learning objects and learning architecture. Learning objects in this paradigm will be active software component (agent) which interacts with other components in the microworld to model the environment. Efforts in creating interoperability components for use in this environment include Ip & Canale (1996); AgentSheets, E-slate (2000) and ESCOT (2001)

Exploratory Learning

Exploratory uses of instructional technology allow students to direct their own learning. Through the process of discovery, or guided discovery, the student learns facts, concepts, and procedures. (Department of Education, 1993) The pedagogical underpinning is closely related to rule-based simulation. The difference is the focus of the exploration. In rule-based simulation, the exploration is restricted within a simulator and the challenge is the creation of the simulation. For exploratory learning, the focus is on information or resource.

In traditional learning environment, the information available to learners (e.g. children in school) have been carefully selected, edited or reworked to meet both the "duty of care" and the learning profiles of the learners. (The school library plays an important role in the selection process.)

However, with the advent of the communication network, resources, including those not originally intended for educational consumption nor for minor, may be available to learners during exploratory learning. (Ip & Naidu, 2001) highlighted the need of rethinking of the issues of availability of material for educational use.

Cognitive tool

(Reeves, 1999) suggests two major approaches to using interactive learning systems and programs in education.

First, people can learn "from" interactive learning systems and programs, and second, they can learn "with" interactive learning tools. Learning "from" interactive learning systems is often referred to in terms such as computer-based instruction or integrated learning systems (ILS). Learning "with" interactive software programs, on the other hand, is referred to in terms such as cognitive tools (Lajoie, 1993; Jonassen & Reeves, 1996) and constructivist learning environments. With the use of such "cognitive tools", learners can enter an intellectual partnership with the computer in order to access and interpret information, and organize personal knowledge. Computer-based cognitive tools have been intentionally adapted or developed to function as intellectual partners to enable and facilitate critical thinking and higher order learning.

Typical cognitive tools include databases, spreadsheets, semantic networks, expert systems, concept maps, communications software such as teleconferencing programs, on-line collaborative knowledge construction environments, multimedia/ hypermedia construction software, and computer programming languages.

Learning objects need to be software which support learning. TAO (Kennedy et al., 1999; Kennedy et al., 1998) doubles as a cognitive tool as well.

Resource-based Learning Environment

Resource-based Learning Environment (RBLE) emphasizes a transformation of meaning through learner-centered, system-facilitated action. RBLEs support and extend efforts to know, understand, and generate, that is, to reflect, construct, solve problems, and integrate new information for one's own purposes (e.g., curiosity, cognitive dissonance) as well as for others' purposes (e.g., research topic, gain varied perspectives on an issue, solve an assigned problem) (Land & Hannafin, 1996). They provide not only comprehensive collections of highly indexed data, information, and search engines, they help learners to reason, reflect, and assess the veracity of the systems' contents.

Traditionally, special collection of resources in library will provide the starting basic of RBLS. Obviously, indexing and providing efficient discovery of learning resource are of prime importance in this environment.

Community Gap

There is an obvious gap between the learning technology community and the education community. We have identified the reuse potential of material in some pedagogical paradigms and used the terms "learning resource" or "learning object" loosely. However, we must acknowledge that such terms are not native to the education community. The issues of reuse, grain size, technical properties or even the basic question of "what is a learning object?" are not central issues in the education community. In the recent years, there are "external" environmental changes (e.g. see Ip & Canale, 1997a) which forced

many educators (a lot of them screaming and kicking while some happily embrace) to work in a digital learning environment. While the learning technology community is struggling to understand the issues in the education community, they are also creating new terms attempting to encapsulate the newly acquired understanding, but in the technologist's language. For example, the term "learning object", borrowing from object oriented design paradigm we presume, tries to encapsulate the concept of granularity and reuse of material. Frankly, "learning object" makes no sense to the education community.

Our current understanding of "learning object" is like t he three blind men's understanding of the elephant.

Should we focus on discovery of learning material and declare learning object is learning asset plus metadata (LOM) - and ignore the other issues of learning asset?

Should we take an "information shoveling" view on learning and teaching and satisfy ourselves with material which are only to be read, focusing on identifying the sub-structure of such material (e.g. learning objectives, competency levels etc) - and ignore the other issues?

Learning object issues are concerned with developing technical systems to meet education and training needs. On the other hand, any system pertaining to deliver learning and training must express its technical construct in the jargon and concepts of instructional design and pedagogical theories. Unfortunately learning and training are complex environments with many stakeholders including learners, instructors, courseware designers or instructional designers and education managers. Even within the stakeholder group called broadly as instructional designers, the pedagogical paradigms reviewed above show as much gap among the paradigms embraced by the participants as the gap between learning technology community and education community. This presents great difficulty for learning technology community to encapsulate and operationalise any of these concepts (if we are lucky to be able to identify them) in the technical design of a generic learning object framework. Is there ONE learning environment which can satisfy all needs?

There is value in taking a more pragmatic approach. Instead of trying to create a framework to enable interoperability and reuse of learning objects across different pedagogical paradigms, we focus on creating a supporting technical infrastructure to enable interoperability and reuse of resources within specific pedagogical paradigms. We have reviewed the ways educators use resources in different pedagogical paradigms. Summarising, these might include

- specifically written up reading material (e.g. cases in case method teaching, problems in problem-based learning)
- reading resources originally created for other purposes (e.g. initial scenario in web-based role play simulation, resources in exploratory learning and resource-based learning)
- multimedia resource used to supply content and convey authentic situations and a sense of authority (e.g. video clips used in goal base learning)
- structured resources designed to be used in some interactive manners (items in tutorial, drill and practice)
- other structured resources which require special software in order to work in an educationally meaningful context, such as those special questions in text analysis object (TAO) which also acts as like a cognitive tool.

Three observations may be made here.

Firstly, an "information shoveling" model for learning and training is not an acceptable generalised learning model for the informed education practitioners. The paradigms reviewed above indicate quite different technical systems for delivery based on each of the paradigm. One size does not fit all.

Secondly, we need a distinction between learning material and teaching material. Risking of the guilt of stating the obvious, learning material refers to material that is used by the learners and teaching material is material used by teachers. A general framework of educational resources, disregarding the differences between use by learner and by teacher, does not help us much here. While any teaching resource has obvious reuse values, teaching resource deserves a separate technical framework to support interoperability and reuse. In the current paper, we focus on learning resources only.

Lastly, while reading is a major activity, learning resources are more than just reading material. The ability to support appropriate interaction is important. The current finding is in line with a previous work by Ip & Canale (1997). They identified the need of different skills in creating digital learning objects and argued for a clear demarcation of responsibilities among instructional designers, subject matter experts and software designers. They emphasized that content and functionality are two independent, orthogonal concepts and should not be mixed. Content, contributed mainly by subject matter experts, can be encoded as structured and unstructured resources. Unstructured content can be rendered by generic software such as the web browser or popular plug-ins. Functionality is provided by software (referred to as rendering software) which is necessary to take the structured resource and provide interactivity in an educational environment.

By enforcing the distinct nature of content and functionality, Ip & Canale's view supports a two-tier courseware development workflow with a production and consumption relationship. Software developers, who work with bits and bytes, produce rendering software for subject matter expert's consumption. Some generic rendering software can be used by different subject matter experts for unstructured material or some commonly known structured material such as some objective testing resources. On the other hand, for any interactivity, any subject matter expert can choose from a range of rendering software from different developers, or may choose to develop the rendering software themselves if they are willing to invest the effort and time! When sufficient rendering software is available, a significant part of courseware development effort would be reduced to a choose-and-pick exercise and hence will result in a lowering of cost and improvement in quality.

So, what is a learning object? Learning material plus LOM plus optional appropriate rendering software?

Conclusion

The observation, identification and acknowledgement of the need of specialised rendering software in different pedagogical paradigms force us to re-conceptualise the underlying meaning of the notion of learning object and question the relationship between learning technology community and education community.

Is learning object the rendering software? Is learning object the content? Can we and should we combine the concepts of content and rendering? When we are talking about interoperability, what do we want to interoperable? Rendering software? Content? When we are talking about reuse, do we mean use of the same content (unchanged) by educators coming from different pedagogical paradigms? Or only supporting reuse for those sharing the same pedagogical beliefs?

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What are the values underlying the current focus of the learning technology community on issue such as reuse, grain size and technical properties? Are these values driven by economical reasons or desire to improve to learning opportunities and outcomes?

This paper analyses the potential of reuse of learning resources from different pedagogical paradigms Ip & Canale's approach, a clear demarcation of responsibility of subject matter expert, instructional designer and software developer, will empower educators to create more innovative educational courseware.

We started with a question: What is a learning object, technically? It seems that we finish with more questions than we have started.

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Mobile Access to Care Services in a Web and Enterprise Computing based Distributed Area

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Abstract: For support of peoples with deficites in information providing and processing as well as for peoples with cognitive deficits a heterogeneous hard- and software based distributed system with mobile access to Internet and Web services is developed and applied. The architecture of the system is an extension of the Mobtel system for patients with brain damages. For a more generalized solution and applications we use the enterprise computing technology (e.g. Java Enterprise Beans) in combination with middleware platforms (e.g. Corba/Java), Web application servers and an architecture for mobile access corresponding the WAP recommendation. The transport and information platforms in the distributed area form the Internet and the WWW. For the mobile access from the care area to the Web based informations special data structures (MML) and protocol suites (MTP) are developed, equivalent WML or HTTP resp. The mobile device, a palmtop-size computer with touch screen, pen and voice output, is connected bidirectionally with the care area via cellular radio network (e.g. ETSI/GSM or GPRS, in future also UMTS). For support of users (e.g. older peoples and brain injured patient) a Web based service center will be established.

Keywords: mobile distributed computing, mobile access to Web, enterprise computing technology, CORBA, IIOP, EJB, WWW applications, cellular and packet radio network, cognitive deficits, telemedicine, telerehabilitation, service center

1 Introduction

The paper describes the support of different groups of user with deficits in information providing and processing as well as with cognitive deficits by means of new Internet and mobile computing technologies. Therefore, we have developed a distributed care systems, consisting of a care area on base a wide area network for connection of the service stations and users, a mobile care area for the access to the services and a service area, which serves for informations, medical services and other personal aids.

Different users, especially older peoples and peoples with insufficent knowledge about the new technologies in communication and information processing, need a help for using computer services and communication facilities and the corresponding services. The new technologies require a permanent refreshing of informations and a lifelong learning in multimedia oriented applications as well as in network based learning scenarios. With the possibilty of support by computer based knowledge, which is prepared by information services and by an access anywhere and anytime, this peoples can better integrated in the new real world under consideration of the quick growth of innovations and technologies.

An other group of users are peoples with cognitive deficits, but the using scenario is similar. Memory disturbances are a frequent outcome of brain damages. The problem of these peoples consist in the fact, that they forget the intentions in future and could'nt remember to the actions which are necessary. Maintenance or enhancement of the patients life quality often requires an enormous effort of caregivers or family members. Modern information technologies offer efficient conditions in medicine and neuropsychology combining communication techniques with neuropsychological methods. The use of bidirectional PMA (Personal Memory Assistant) enables the therapist to supervise and manage the actions of brain damaged persons even outside the clinical setting thereby being assisted by the patients family members.

By using modern software technolgies and communication techniques we have developed a mobile distributed system, based on Internet and WWW as well as a wide area mobile communications in form of a cellular radio network or packet data radio network. To support heterogeneous hard/software basis we use the componentware EJB (Entreprise Java Beans), the middleware platform CORBA (Common Object Request Broker Architecture, with POA, Persistent Object Adapter, and IIOP, Internet Inter-ORB Protocol) and Java or JavaScript programs. The architectural concept is modelled and realized completely as an object-oriented system. The evaluation of the system follows in municipal regions with different user groups and in a daycare clinice for cognitive neurology at Leipzig University (see Irmscher, K. 2000 and Thöne, A.I.T. 2000).

2 System Overview

For support of the different user groups we have chosen a system concept, based on the following objects in view:

- object-oriented architecture (using UML, Unified Modelling Language),
- heterogeneous platforms (hardware, software),
- componentware and middleware, supporting the connection to the Internet and mobile radio networks,
- using commercial communication lines and services,
- wired communication (narrowband and broadband) and wireless communication (ETSI/GSM or GPRS resp.) techniques,
- mobile access to Web (WAP or mobile IP),
- development of of a generic application support (appropriate data objects and taskplans),
- extensibility in architecture and services,
- faulttolerant and scaleable architecture,
- development of a service center for user support.

The architectural concept is founded on experiences from another project, called Mobtel for patients with memory disturbances (see Schulze, H. and Irmscher, K. 2000; Irmscher, K. 2000). The in this paper proposed extended distributed care system consist of three areas, a care area using Internet, a mobile area and a service area, as shown in fig. 1.

The care area on base the Internet serves for the access from different user stations (clients), for the management of workflow oriented processes and for the transport of the informations between the stations and to the connected service providers. The basis of connections form the Internet, the important information base are the contents of Web servers in the environment. The care area is heterogeneous with respect to hardware and software components. For realization of the care area an enterprise computing technology is applied, based on the componentware EJB (Enterprise Java Beans) in connection with a CORBA middleware platform. By using the IIOP (Internet Inter-ORB Protocol) follows the connection to the Internet and Web resp.

For mobile access to the services, given from different Web services and services in telemedicine and telerehabilitation a mobile care area is established. The main components of this mobile care area are bidirectional working mobile devices in form of handheld computers and organizers (so called PMA: Personal Memory Assistant) and the components of mobile communications. The access to the Internet and Web services follows by using a special architecture, similar to the WAP architecure (WAP: Wireless Application Protocol). Therefore we have developed a appropriated data structure MML (Mobtel Markup Language), like the WML (Wireless Markup Language) defined from the WAP forum and a communication protocol MTP (Mobtel Transfer Protocol), compatible to the Web oriented application protocol HTTP (HyperText Transfer Protocol). This developments are extensions and improvements of results from a predecessor project Mobtel (Mobile Telerehabilitation, see Irmscher, K. et al. 1999 and Irmscher, K.; Schulze, H. 2000), reported also at WebNet'2000 in San Antonio (see Irmscher, K. 2000).

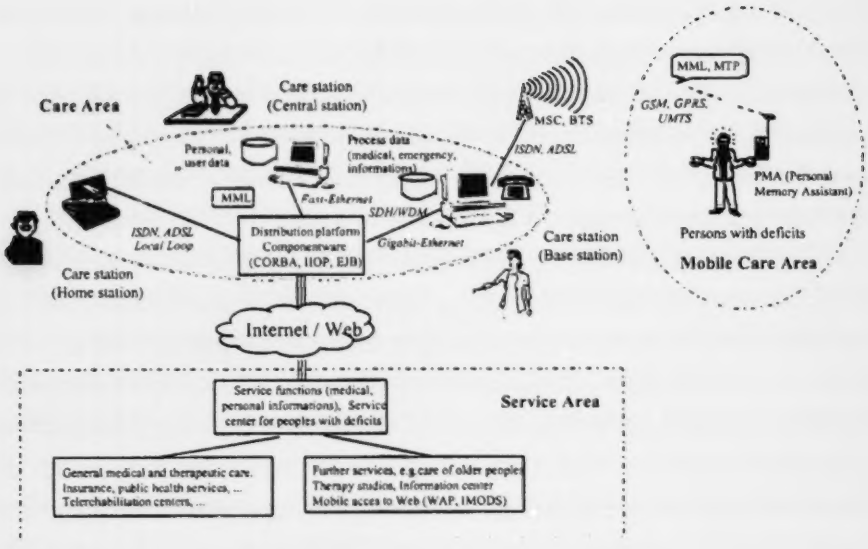

Fig. 1: Distributed care system with mobile access by using bidirectional PMA (Personal Memory Assistant)

In preparation of service providing and trading a service center is to be developed. About this center all the prepared services are available in depence of user autorization. Some service functions can used without costs, but for general services here also the commercial conditions are valid in the same way as in distance learning processes.

The implementation follows by an interdisciplinary project, called MOBREGIO, in co-operation with partners at Leipzig University (Chair of Computer Networks and Distributed Systems and the Daycare Clinic for cognitive Neurology) and RBM electronic-automation Leipzig. The project is sponsored by the German federational ministry for research and education (BMBF).

3 Architecture

The main component of the distributed care system is the care area, based on the middleware platform Corba and the componetware system EJB (Enterprise Java Beans). About the IIOP interface (Internet Inter-ORB Protocol) the services of WWW can used.
The object-oriented architecture of the proposed care system allows the realizat ion of an extensible, scalable and fault tolerant system. Using generic control and data structures ensures, that the system is applicable to a broad class of operation scenarios without any adaptions at source code level. Corba as middleware platform guarantees efficient software development on heterogeneous hard/software without using proprietary software and allows an easy extension of the system by adding new server objects or user interfaces for different user groups. The user (e.g. older peoples and brain injured patients) are equiped with a specific palmtop-size computer. The user interface is adapted to the restricted abilities of the users, especially of the brain injured patients.

For generalization of the architecture and to guarantee the re-use of the software components a container based solution is applied, based on the Enterprise Java Beans componentware. The containers content the application

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processes (e.g. information services, taskplans for patient treatment). About different interfaces the processes are connected to client for users and for administration. The access of users in the wired network follows by an Web application server, serving for the services, the user administration and for security services. The application server and the application services in the containers use also the connectivity to a data base system, needed for information storage and transaction services. For connection of mobile devices special gateway processes are required for transformation the different data structure and protocols for mobile communication.

For the wireless connection between the mobile care area and the service station in the fixed network care area serves a cellular radio network, in our case based on the standard GSM (Global System for Mobile Communications), standardized by ETSI (European Telcommunications Standardization Institute). On this communication bearers the well-known Internet/WWW protocol stack PPP, IP, TCP, HTTP is applied. For the mobile access, a data structure like WML (Wireless Markup Language) is used, which allows also the mobile access to the Internet and via IIOP to the Corba-based care region. For realization of the functions a special script oriented specification language MML (Mobtel Markup Language) and an appropriate transfer protocol MTP (Mobtel Transfer Protocol) are developed, both analogous to WML resp. HTTP in the Web architecture. In extension also new communications technologies are used, e.g. the GPRS (General Packet Radio System) with higher transmission capacity in comparision with the 2nd generation mobile radio systems like GSM or DCS. In future also the next generation of mobile communication (UMTS: Universal Mobile Telecommunications System) is object of our investigations and is to integrated, if the technical infrastructure is installed.

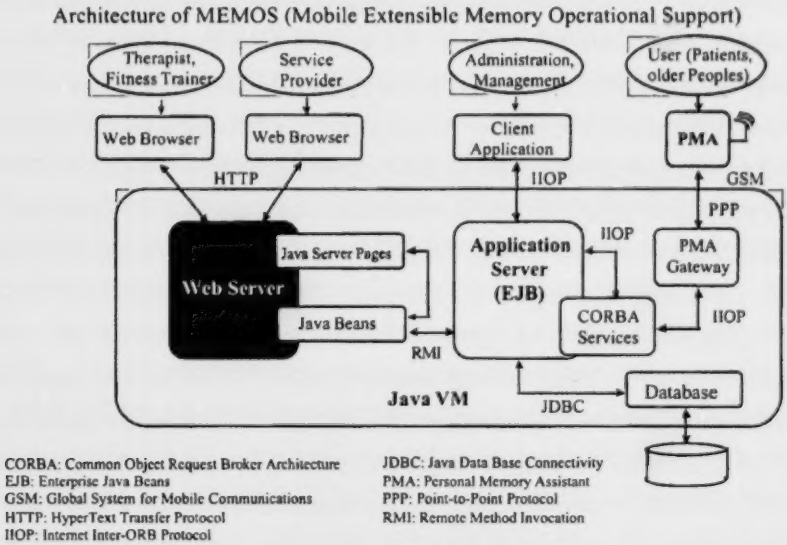

Fig. 2: Architecture of the distributed care system and the prototypical implementation MEMOS

Main focus in this paper is the development of a distributed heterogeneous system which considers especially the needs of peoples with deficits in information processing, of pain patients in ambulante medical treatment and of brain disturbed patients, the unreliability of mobile communication, the limited resources of the mobile device and a heterogeneous care area. Furthermore, the base system provides the basic services in the wired network, which can handle the unreliable connections to the palmtop, which is extensible to new services, scalable and fault tolerant. With the EJB and Corba architecture the possibilities are given for heterogeneous systems as well as the connection to Internet and Web services using the IIOP (Internet Inter-ORB Protocol) facility. In Fig. 2 the architecture of the prototypical implementation MEMOS (Mobile Extensible Memory Operational Support) is shown, based on EJB, CORBA, IIOP, Java Server Pages and a gateway for mobile access.

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The connection to the mobile user devices are established by a special server (pager gateway). This gateway is a Corba object for the base service system as well as a socked based server for the palmtop. If the palmtop connects to the gateway it asks the gateway for a list of new or updated decks and loads down all MML files for these decks. Such MML files can be stored by the pager gateway or they are created dynamically. Therefore the gateway connects the corresponding pager proxy object.

The user interfaces are designed as thin clients. This approach has several advantages. The business logic is implemented only once a time. Adaptions can be done without changing the user interfaces. The user interfaces are implemented as Java objects and connect the base system using its Corba interfaces, other user interface types as Java applets or a Web interface using servlets, Java server pages or CGI scripts (Common Gateway Interface) easily can be implemented. In further steps also the mobile access to Web-based services via portals will be taken into account.

4 Mobile Access to Web

The interactive work requires an online connection between service providers and users by mobile communication, to realize the mobile access to the Web services. The WML-like data structure MML serves for mobile access to the care and information services, prepared automatically by the service station in the fixed network (taskplans). This architecture also can used for general mobile access to further services on special Web servers, similar to WAP technologies described by WAP forum (Wireless Application Protocols). For disposal of Internet contents on mobile platforms the language standards WML (Wireless Markup Language) and HDML (Handheld Device Markup Language) are developed. Both are action- and event-oriented structured and matched to HTML (HyperText Markup Language). WML is a tag-based document language, defined with XML (eXtended Markup Language) and considers the device resources are limited (diplay size, storage, power). A HTML page in WML is called a "card". Near by can be distingushed into display cards (for notice), choice cards (for choice) and entry cards (for input, generally text oriented). Several cards within a WML document are collected as a "deck" and transmitted summarized. The in WML formated documents are kept on corresponding servers and can be transmitted via an air interface to the user agent (browser) on the mobile end device and there displayed with a micro- or WML-browser. Since existing markup and scripting languages like HTML/JavaScript or WML (Wireless Markup Language) are not applicable to our system, because they are either too complex or too simple, we developed a special markup language (MML - Mobtel Markup Language), which enables a partial autonomy for the pager, but is not too complex for mobile bandwidths, and a simple transfer protocol (MTP - Mobtel Transfer Protocol) on top of TCP, which considers the special features of the proposed architecture.

Analogous to WML a set of linked cards is called a deck. Every task a patient has to solve consists of one or more decks. At the mobile level the pager only knows decks and cards, but on the base system and user interface level we only consider tasks. The data structure for tasks forms a graph (taskplan). For every activated task a proxy task object is created, which manages the creation of the corresponding MML-description, the transmission to the palmtop and supervises the status of the task on the palmtop by analyzing the pager logfiles. If a critical state is reached, the pager object sends a message to the caregiver, using SMS (Short Messaging Service), email or a simple pop-up window.

The pager should be also usable for patients with cognitive deficits, so it must be fault tolerant and very easy to handle. The ergonomic design is to keep very simple, therfore our architecture has only few hardware buttons. All other interactions are performed using the touchscreen. With the GSM module a voice or data connection can be established. The voice connection is used for emergency calls to the therapist or doctors or to make appointments with a caregiver. The data connection is used to send new tasks to the pager, to update or delete tasks and to receive logfiles from the pager.

A major problem in the development of the palmtop is the standby time of the mobile equipment. If the base system requests a communication to the palmtop, a message will be sent using the Short Message Service (SMS) of the cellular radio network. If a SMS message arrives requesting a connection or other reasons for connecting the base system, the palmtop connects to the base system and establishes a TCP/IP connection using PPP (see Black 1995 & Walke 1998). The functions and protocols used are supported by the operating system Windows CE for the interactive pager device.

4 Service Center

The prototypically developed mobile and distributed care system is completed by a service area. About this center all the developed services are available and also a support is given for users.
In the case of brain injured patients the daycare clinic for cognitive neurology at Leipzig University provides the users with the services are necessary. For evaluation trial persons was equiped with the bidirectional palmtop-size equipment. The service system is located in the clinic and connected with the mobile devices by ISDN (Integrated Services Digital Networks) and radio telephone connections using the ISDN/GSM gateway of a telephone provider. The stationary care system in the clinic can be extented with further care stations (e.g. home station) about the Corba bus. Therefore, the additional care stations have to establish an ordinary Internet connection. In similar way the patient in ambulante medical treatmants can be cared. A medical service is to establish in co-operation with medical doctors or therapists. On the basis of taskplans a better treatment and medical care is possible.
The service area serves also for the connections to the public and private organizations in the Public Health Administration and to the insurances.

An other field of applications offers the preparation of informations and the processing of informations for peoples, which have problems to understand the new technologies and also to handle the lot of new devices and software solutions in the daily life. The services can filter the informations for the special users, can prepare the contents until to providing of general informations in connection with a global or local positioning system, e.g. the program in the cinema, train time tables and itineraries.
For application of the technical development different services are developed and evaluated. In progress of the project we will investigate some possibilities for services, can be provided by the service center. For permanent using a service on a commercial base is to prepare after ending the project phase.

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Instructor-Designed Course Websites at a Small College: A Case Study

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In this case study, instructors at a small liberal arts college will first describe their investigation into the development and implementation of instructor-designed course websites. Since the college does not support a network-based Web course development system such as WebCT or Blackboard, instructors who wish to incorporate a web-based element into their instruction must create course websites on their own using web-editing software such as Netscape Composer, BBEdit, or FrontPage. The authors will explicate and categorize the current uses of instructor-designed course websites in order to formulate an understanding of how instructors' use of the Internet may have influenced pedagogy. They will offer an analysis of the findings. They will conclude by looking carefully at the factors that may inhibit instructors' use of the Internet in their teaching and suggesting ideas for amelioration.

Keeping the Door to your Community Open: A Year in the Life of our Campus-wide Learning and Information Portal

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Abstract: Developing pedagogically sound, technology-based solutions that are pervasive and economically viable, yet flexible enough to meet diverse needs can be challenging. This panel session highlights key success factors for schools contemplating the implementation of a campus-wide e-learning platform as well as cross-functional support models and services necessary to manage increasingly sophisticated user needs. Topics include: system administration, training, support, faculty development, advertising, and community building.

Background:

In 1998, a Worcester Polytechnic Institute (WPI) professor piloted an online course management system. The pilot failed to lift off for many reasons and the professor's department lost a considerable amount of money. Many professors returned to using web pages to disseminate their course materials. Our web development office became inundated with requests for additional course web pages and maintenance of existing pages.

After careful examination of this pilot failure and the request for relief from our web development office, WPI formed a committee in the Spring of 1999 to select a commercial online course management system. The committee included faculty and staff with various levels of technical abilities. The committee was charged with the responsibility of researching vendors, surveying the needs of our faculty, attending demonstrations, and voting on one system to be implemented over the following summer. As the committee deliberated, a support team was also created with the intent that they would eventually handle the rollout, training, services, and support.

Our key factors for the implementation of an online course management system were:

- The creation of a "key-stakeholders" selection committee
  - consisting of "technophobes" and the "technically savvy"
  - willing to engage their peers to take advantage of this technology

- fostered a democratic selection that justified the final choice

- A thorough needs-analysis and democratic prioritization of needs
  - included a literature review of over 25 companies
  - established 45 criteria which was then narrowed down to 6 priority needs

- The formation of a collaborative and cross-functional support team
  - specific staff from our instructional media center, computing center/training, and library/web development offices
  - online help form, email mailing list, group and one-on-one training, FAQ's and instructional design support
  - allows for pooling of technical resources and overlapping services
  - "one-stop" shopping and fast response time

The committee selected Blackboard 5.0 as our online course management system and it was rolled out in the Fall of 2000 as a campus-wide leaning and information portal. We chose to brand the campus portal as "myWPI," to give users a sense that the portal was a part of the university, and not just another experimental piece of software. Within the first academic year, we had over 200 myWPI course sites.

Integrating the portal features into myWPI allowed us to augment wider efforts to create a greater sense of community for the campus. The myWPI portal added a "virtual" community to the existing campus and extended the reaches of this community beyond the physical campus to satellite campuses, project sites, distance learners, and just about anywhere with Internet access.

What we did and why:

The first thing WPI did was form a collaborative cross-functional support team. The team was named myHelp and consisted of a system administrator, computer trainer, web coordinator, online delivery specialist, and an instructional designer. A myHelp alias was created to handle all questions related to using the myWPI system. The myHelp team held monthly meetings to go over bugs/fixes/system upgrades and discuss current issues related to using and maintaining myWPI.

Of the many pieces to a successful campus portal, the driving force is the hardware and software working in the background. Maintaining a successful portal not only entails constant support for the actual portal hardware and software, but also having strong ties with other aspects of our university's Information Technology infrastructure. To maintain data integrity on campus, we must keep only one database, Banner, and myWPI has to work with that database. Existing systems in place for the WPI community had to be integrated into myWPI. Hardware and software issues relating to clients access of myWPI had to be accommodated for.

Once the system was installed, tested and deployed across campus, marketing and public relations efforts began to inform the community and encourage use of the new resource. Training sessions were developed and scheduled a few weeks before the beginning of classes and at the beginning of the year. Email and print announcements about the system and training sessions were sent to members of the WPI community through community newsgroups and newsletters. Training continued throughout the year, and was expanded to include one-on-one training sessions for faculty and staff. Members of our instructional design staff led additional information sessions and workshops for the entire community and customized sessions for individual departments in the areas of myWPI basics, teaching with technology, and pedagogy. Members of the myHelp team met with the Student Government Association to address student concerns and questions about the portal.

Print and online marketing materials have been developed. An extensive help and Frequently Asked Questions (FAQ) Web site (including streaming media training videos) was created to offer help for common problems. Advertisements will appear in the university-issued student planner and the student newspaper in Fall 2001. We have also created and are continually developing various handouts and tip-sheets for faculty and students.

Lessons Learned:

The successful implementation of a course management system has allowed us to focus on Faculty and Course Development rather than coding HTML, to combine synchronous and asynchronous content and activities, to empower faculty to create their own pages, to provide consistency for students, especially distance learners, and to provide "One-stop-shopping" of course and community resources.

It was important for us to handle problems in a manner that would solve the problem while diffusing negative experiences with the portal system. During system downtime or planned upgrades, e-mail announcements were mailed to the community to let them know when the system would be unavailable. In the case of unplanned downtimes, we spread the word as quickly as possible. We also addressed concerns that came up during group training or individualized sessions, solving problems when we are able and forwarding questions and problems to Blackboard that we are unable to solve or work around. The process of maintaining myWPI is in a constant state of evolution.

Future Goals:

When myWPI was launched, we knew that it would quickly become an integral part of campus life at WPI. With myWPI being such an integral part of WPI, it is essential that it progress and grow with the campus as well as be a constant fixture on WPI's network. In the first year we have worked with the software, it has become clear that rich media will be an integral part of teaching and learning online, and myWPI must be able to adapt to this change, and any new technology changes in the future. People rely on myWPI, and it must meet the 24x7 availability standards that are required. In order to help meet those standards we started with a robust set of hardware with plans to reevaluate storage every six months, and entire machines every two years. We also will continue to look at new techniques for clustering to not only support fail-over situations, but load balancing as well.

One of our future goals with regard to support and services, is to enhance support services by partnering our existing support team with our computer helpdesk allowing for more phone support and help ticket tracking. We are also considering the purchase of a toll-free help phone number for off-campus support (Advanced Distance Learning Network and project centers).

In the future, we hope to expand our virtual community portal to more accurately reflect the extended community of WPI. Access to the portal is currently being tested and implemented for incoming and accepted students. We also have plans to provide access to alumni. We will update and change our marketing efforts to reflect the changes in the community. We also hope to empower our users by providing additional training not only in the system itself, but, in related skills, such as instructional design and preparing course materials for the web.

Unlocking Key Barriers for Staff on the Path to an e-University

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Abstract
This case study identifies key barriers for staff on the path to an e-University, and suggests ways to unlock these. The focus of this evidence-based research is an eUniversity pilot development in virtual learning in progress at the University of Greenwich. Documentary evidence for the study included feedback from twelve sub-projects in the overall development designed to test "fitness for purpose" in delivering an MSc e-Commerce degree programme. Written commentary from staff on the steering group and from professional external facilitators PricewaterhouseCoopers on business modelling provided evidence of key barriers and suggestions on ways to overcome them. The authors took as their guiding principle a main focus on delivering excellence in learning for students. To recommend successful methods of unlocking the main barriers for staff on the path to an institutional implementation of e learning, an "e-University Key Barrier Matrix" was developed.

Background

In the current global stampede to convert courses for web-based delivery, the identification and unlocking of key barriers to successful whole-institution implementation of e-learning is possibly the single most important competitive advantage a university can possess. In this short paper, we deal with this issue in relation, particularly, to staffing issues. The focus on "barriers for staff" is deliberate, in recognition of the "make or break" significance staff at a range of levels can have in the institutional change processes involved in introducing e-learning (Hall, 2001). The locus of our study is the University of Greenwich - a UK regional university for South East London and Kent, with a number of areas of international expertise, and a main campus situated at the historic Wren-designed Royal Naval College site in Maritime Greenwich.

With almost 18,000 students on undergraduate and postgraduate programmes, the university has responded to emerging demographic trends of student study-work combinations by widening its range of part-time and flexible study routes. Increasingly, e-learning initiatives have been developed, innovation-driven by expert staff enthusiasts. The recent launch of a UK-wide "eUniversity" by the Higher Education Funding Council for England (HEFCE, 2000), combined with funding for strategic learning and teaching initiatives has enabled further edevelopments. Greenwich is one of those UK universities now systematically preparing itself for "fitness for purpose" in e-learning through an e-University (e-U) pilot HEFCE-funded project.

To integrate e-learning into the university, and re-think students' learning in terms of e-facilities as recommended by previous researchers (Laurillard, 1993), the e-U project was conceptualised in relation to the university's Framework for Learning (Humphreys, 1998). In this Framework, learning is envisaged in terms of a number of generic delivery functions (University of Greenwich, 2000). Twelve e-University sub-projects were mapped against these delivery functions to act as a test bed for the university's capability to support learning using facilities, resources and services for electronic delivery through a pilot master's degree programme - an MSc e-Commerce - to be delivered 100% on-line. All aspects of elearning delivery are being tested and

evaluated for "fitness of purpose", so that edelivery of each separate facility can, once "fit", be applied selectively to a range of mainstream degree programmes. The sub-projects cover all aspects of learning and related support infrastructure. Each sub-project has a clearly stated aim with related tasks and is led by a member of academic, technical or administrative staff with expertise in the sub-project area (ibid.). The outcome of overall will be the delivery and evaluation of the MSc and the selected mainstreaming of the sub-projects.

Method of Identifying Key Barrie rs on the Path

In travelling the e-University development path, we have encountered particular barriers to progress that are particularly important for staff. We have found it useful to identify these barriers, prioritise those that are key to success, and find a range of ways of overcoming these. Evidence-based research in the form of a descriptive case study (Yin, 1994) can be a helpful way of enabling an institution to examine the implementation of innovations in learning and teaching, with the aim of developing good practice. Our identification of key barriers for staff and recommendations for the resolution of problems connected with implementing this kind of "borderless education" is informed by prior work on the subject of e-learning (CVCP, 2000). We recognise that these obstacles are not unique to us. However, we anticipate that sharing local perceptions of e-barriers and ways round them with a larger audience will be a valuable and relevant exercise for us all as we engage in dialogue and exchange of experiences in the implementation of virtual learning. In identifying barriers to progress, written evidence from the steering group for the project, and the report of an external facilitator from PricewaterhouseCoopers (Block et al, 2001) was utilised. A range of problems was identified from the examination of these sources. These can be grouped under the general headings of institutional distractions, leadership and skills issues, e-critics, communications and overload problems, and quality barriers.

Key Barriers Identified

Key Barrier One - Institutional Distractions

At the time of implementation of this virtual learning project, the university was undergoing a major restructuring. This change was perceived by the e-University steering group as a potential distraction. A general institutional focus on restructuring drew some staff away from the aims of the e-U project. A number of staff due to complete sub-projects were pulled out to complete important work needed for restructuring. The "hard data" perceived as necessary by the external facilitator for business modelling was not forthcoming by the specified date, staff were forced to cancel meetings and were unable to carry out work as originally agreed.

A tendency to marginalise the virtual learning project occurred through these distractions. Staff regarded their main University work as more important and significant than the e-development. The perception by some academic heads of department that the virtual learning project was an unnecessary drain on staff time did not square with the investment in funding provided to release lecturing staff from other duties. Simultaneously, some unclarity arose about the perceived overall institutional aims of the virtual learning project. One staff member commented, "I'm kind of confused about where we are and where we are going." Different perceptions arose about the main focus of the e-University: a separate entity with its own name, market, staff and facilities, or a complementary enhancement of the mainstream activity of the university. Significant institutional distractions can arise in the implementation of virtual learning. This is more challenging in a situation complicated both by comprehensive institutional change and by confusions in perceived aims.

Unlocking Barrier One – Stay Motivated and Keep Your Eye on the Ball!

In our case, the knowledge that the e-University development will make a positive contribution to the university's new structure has been an incentive to continued motivation. The original specification of the project as a vehicle to test "fitness for purpose" in virtual learning against the Framework for Learning had a useful degree of conceptual integrity for student learning. The guidance of managers to concentrate on "keeping your eye on the ball" at a time of major institutional change was helpful in retaining staff motivation and steering the project through uncertainties. Staying motivated and focussed on the original aims of the eproject therefore unlocks the first obstacle of institutional distractions.

Key Barrier Two – Confused Perceptions of Leadership and Decision-Making

In terms of leadership, differences in understanding the remit of project complicated decision-making, as a number of levels, strands of management and committee structures were involved. Swift decision-making was hence impeded, as recommendations for decisions suggested by the steering group for the project were not always in tune with the ideas of all, and a range of staff at different tiers in the university needed to know, understand and agree with the aims of the project. A variety of expertise in and enthusiasm for e-learning existed at different levels of management. Institutional recognition of who precisely was "leading" the project was sometimes perceived as unclear, as there were "leaders" at different levels in a somewhat longish chain of command. Enthusiasts at a number of hierarchical levels were perceived by staff in the steering group to have a leading role in knowledge and experience, while others, more remote, might have actualised authority in terms of decision-making on, e.g. finances. Such discrepancies could lead to delays, misunderstandings and confusion.

Surmounting these particular barriers has required a number of small forays into what Schön (1983) calls the 'swampy lowlands' in order to get back onto the main path. A major strength in this has been the existence of the twelve sub-projects (University of Greenwich, 2000). As each worked to a mini business model, progress on individual projects made contributions to the whole. Sub-projects developed at varying speeds - when one area of development was behind schedule, another was demonstrating substantial advances. This assisted cross-fertilisation and transference of ideas and skills. Regular project meetings were essential to facilitate this process. Werner comments (Werner, 2001) that effective results from this kind of small-scale focussed sub-project work is critical – "cultures change when pockets of people find success and the word spreads".

A vital area for decision–making has been that of determining the appropriate virtual learning environment to be used in the e-University. The chosen platform had to provide electronic access to all relevant facilities, resources and services of the e-University and be compatible with existing hardware/software used by the university as a whole. One sub-project was briefed with the task of identifying a range of virtual learning environments (VLEs) and evaluating their relevance and usability. A major problem was that a decision was made at the outset to adopt a particular commercial VLE for new developments, before the sub-project team had been able to evaluate a range of available platforms, whilst existing e-learning provision was using a different VLE. The solution to this problem was that, for the initial stages of implementation of the e-University, more than one platform will continue to be used. This has the disadvantage that in the short term more staff development and ongoing technical support is needed but the advantage that when a decision is finally made to use only one platform, it will be a fully informed strategic decision arising from extensive evaluative comparisons.

Unlocking Barrier Two – Identify Leadership, Achieve Consensus

In opening up this second barrier, it is helpful to all if clear leadership of an e-learning development is identified at a number of levels from the outset, and decision-making processes are clarified and disseminated. As Hall notes (Hall, 2001) a steering committee involving a range of functional managers can be useful. Delegation of specific areas of decision-making can promote local ownership, while a wide-ranging process of consultation is vital to ensure the sympathies and understandings of participants are engaged, and that staff feel that they "own" the project. This combination of clear leadership and effective consultation has been useful to achieve a growing consensual university-wide understanding and ownership of the role and purpose of e-University developments. Public support for the project from top University managers has been vital in this process.

Key Barrier Three - Skills and Staff Development Issues

The identification of staff with appropriate skills for the implementation of a vehicle for testing "fitness of purpose" of the university for e-learning was complicated by some lack of recognition of existing staff expertise. One learning and teaching developer commented, somewhat nostalgically, "... five years ago we were ahead of the field in the development of interactive collaborative learning on line ... in planning any future e-University, we need to retain the raison d'être for e-support in its original form, i.e. to support learners who feel isolated.. and retain and extend the expertise ... good and motivation of original developer/enthusiasts who are our e-University champions." (Block et al., 2001)

The implementation of the project did not automatically achieve this, as the selection of staff did not initially draw on this original group of enthusiasts. Latterly, however, enthusiasts for e-learning were drawn in, to utilise their expertise, as were new staff with unique and hitherto unutilised vital skills in instructional design and applications development. Both original and new staff with e-learning experience have acted as advisors and mentors to those developing the MSc e-Commerce. In some ways this work highlighted as many problems as have been solved, as the pedagogical model for the MSc eCommerce has so far been predominantly a transmissive didactic one (Moll et al 1993). The development team have focused more on translating lecture materials into web format than on utilising the potential of the web for creating a collaborative, peer-supported transactional learning environment (Jordan and Ryan, 1999). The pressure on the development team to prepare the programme for validation procedures has inevitably made staff somewhat resistant to embrace new or different models of learning and the MSc has initially had a teacher-centred format. The positive aspect of this is that the nature of web-delivered materials lends itself to development more readily than paper-based distance learning materials and the team are keen to participate in activities aimed at facilitating ongoing and dynamic enhancements of the programme. Re-examining the nature of the learning experience itself remains a key focus in the management of the project, and one which has *not* been subject to confused perceptions – the core value of providing excellence in student learning has been a useful common denominator in ensuring staff commitment to skills development.

One recommendation of the Business Modelling Day (Block et al., 2001) was that "An organisational migration plan is required to implement this strategy as an enterprise-wide e-learning model." A move to wider e-learning requires the involvement of more staff who need development to engage with the technological and pedagogical aspects of e-tutoring. Not all staff are interested in acquiring new skills and many of them see e-learning as a threat to the status quo. This is a particular problem when a major restructuring threatens job securities.

Unlocking Barrier Three - Value and Develop Staff, Identify and Use Expertise

To open up barrier three, a recognition that staff expertise and enthusiasm is a valuable commodity in the implementation of an eproject can be helpful. It is important to engage sympathies, involve staff and ensure that training, mentoring and advice is available. Developing a more sophisticated pedagogical model for collaborative peer-supported interactive learning can be achieved through such processes. The recognition of core values can be a useful common denominator.

Key Barrier Four - e-Critics, Communications and Overload problems

Problems arose in working across all university schools. Perceptions of academics that the eproject was a potential threat to their futures echoes the considerable effect that this "major renegotiation of pedagogy and authority" (Faigley, 1998) - perhaps inevitably bound up with the introduction of on-line learning - is having globally. Just as environmental critics of the internet argue that "when our own communities have become unsafe, uncertain, unpleasant, and ugly, we seek artificial ones" (Faigley, 1998), so academic e-critics have argued that the nature of learning is, inevitably, negatively affected. A perceived diminution of educational integrity is regarded by some as a necessary downside to e-learning. To counter such criticism, which can arise from those with least experience of eworking, it is helpful to have excellent, regular communications and information dissemination on the developments involved, and to be effective in keeping to deadlines. Considerable difficulties can arise with workload to achieve this, however. Staff in this eU project were seconded from full-time university jobs. Problems arose with staff workloads already very heavy with routine university work and meeting deadlines was an ongoing problematic issue. This is a common issue in many work areas - staff with particular skills are often called upon to carry out additional duties. The solution will be that, in time, as specialist skills become more widely cascaded, more people will be available to meet new demands.

Unlocking Barrier Four – Communicate Well, Release Staff from Overload

To counter e-Critics, good communication in "frequent, specific messages" engaging staff in real conversations about acknowledged problems, and meeting deadlines effectively through "high intensity participation" can be crucial (Werner, 2001). Cascading specialist skills and releasing specialist staff from mundane duties to enable concentrated e-development can free up overburdened staff and help the project succeed.

Barrier Five - Quality Problems

A major consideration in our thinking and development has been to ensure quality in e-provision. Quality is an overarching concept referring not only to materials provided but to all aspects of the learning experience, including student support, access to resources, technical back-up, and the match between pedagogical models, subject areas and students' entry abilities. Close attention to quality is important to safeguard the institution's reputation, although a cynic might suggest that the ultimate arbiter of quality will be the consumer. E-learning quality issues need to be monitored carefully: they are not the same as the quality issues in conventional learning. Just as pedagogical models do not necessarily transfer effectively from one mode of delivery to another, neither do quality assurance mechanisms. The focus has therefore been on the development of quality standards and protocols for materials design, technical and web page specification, registration, induction formats and other critical processes. According to a CVCP study into the implications of global borderless education.... "for some time to come, borderless developments are likely to add significant complexity to the task of quality management at institutional, national and international levels" (CVCP, 2000). Innovators of e-learning can perceive that bespoke remodelling of existing quality assurance processes is over-rigorous and unfair to them, but the aim is to provide clear quality assurance checks (QAA, 1999).

Key Barrier	Nature of problem	How to Unlock Barrier
1. Institutional Distractions	• Institutional distractions and lack of focus • Confusion about e-learning institutional vision	• Agree terms of focus clearly with senior managers, disseminate this throughout project, ensure other issues do not distract staff and keep your eye on the ball! • Conceptualise e-University within overall vision for learning: re-think learning in relation to electronic delivery, challenging existing perceptions of and prejudices against e-learning, disseminate vision widely • Brainstorm benefits and opportunities • Draw on ideas and knowledge of enthusiasts • Focus on small-scale effective results ; hold regular meetings timetabled with project staff
2. Perceptions of Leadership	• Perceived unclear leadership • Confused perceptions about decision-making • Feelings of not being informed • Perceptions of top-down management structures	• Clear leader(s) identified at a number of levels • Roles and reporting mechanisms and decision-making e.g. on finances clarified and disseminated • Disseminate information widely with messages from the observable leader, with feedback loop • Some leadership tasks devolved to sub-projects to maintain progress
3. Skills	• Lack of skills of staff involved • Staff with appropriate existing skills not identified • Models of learning selected inappropriate for e-learning programme being developed • New, unproven VLE introduced, whilst long-used, proven VLE sidelined	• Staff development • Identify and involve e-learning 'champions' • Identification of appropriate pedagogical models for implementation; staff development, mentoring and guidance in models of learning • Identification of all requirements for VLE, mapped against facilities from a range of platforms: maintain both platforms whilst full evaluation continues and compatibility issues explored
4. e-Critics and Communications problems	• e-University project perceived as a threat by some e-Critics or not considered at all by many	• Dissemination of information about project through individual discussions at School and subject group level. Use internal publicity mechanisms (newsletters etc) to market project Consider the views of e-Critics, engage staff, acknowledge problems, provide answers
Staff overload	• Staff involved already overloaded	• Delegation of tasks wherever possible • Cascading of specialist skills
5. Quality	• Risk of poor e-learning practice	• Attention to all aspects of quality assurance • No shortcuts in quality assurance processes and checks on e-delivery • Ongoing materials development to enhance e-learning quality

Table 2: Key Barrier Matrix for the e-University of Greenwich Development

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Unlocking Barrier Five – Concentrate on Achieving Quality – No Shortcuts

The assurance of quality in content as well as in the general learning environment is essential for effective e-learning development. No shortcuts should be allowed in this process, or customers will vote with their feet. Therefore in achieving the opening up of the final barrier – quality – hard work by e-learning practitioners, in concentrating on effective quality assurance of all aspects of the e-learning programme, is vital.

Key Barrier Matrix for the Implementation of an e-University

The researchers jointly developed an "e-University Key Barrier Matrix" to identify and overcome difficulties encountered in implementing e-learning. This matrix (Tab. 2) summarises key barriers discovered locally in setting up the e-U project. Not a definitive list of all possible barriers, this is a local reflection of problems and solutions we encountered. We provide this matrix to share in developing good practice models for e-learning.

Conclusion

In this paper we have drawn upon the experiences of one institution in developing an e-University, to highlight key barriers to progress. Not all barriers have been identified and in this short paper we cannot reflect in full detail the factors that facilitated our progress. This paper only presents a part of the story. It will not be until this development project is completed and the e-University implemented that we will be able to reflect fully on our experiences and evaluate the outcomes. But to share with a wider audience this identification and unlocking of key barriers is to open up the path to e-learning, with the specific goal of learner achievement in mind.

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Cross-Media Consumption
New Patterns in Web and TV Usage in the Home

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Abstract: The massive and continued popularity of television, still reaching a mass audience, and the dramatic growth of Internet access in the home over the last few years, necessitates a better understanding of how these two powerful media effect one another and how they can be used in concert as communication media. The purpose of this paper is to describe and discuss the current convergence of Web and TV, including the interplay and new dialogues between the two media and new usage patterns, especially in the form of so-called cross-media consumption. First, the new relationship between the Web and television as media will be discussed. Second, findings from different international studies of Web and TV usage will be summarized. And third, findings from a new empirical study of cross-media consumption in the home and the new interactive user-viewer, conducted in a cable network in Denmark, will be reported.

Introduction

Television is one of the most successful technological consumer products ever produced. It has spread to virtually every household in Western society; the TV set is often located in the central part of the main living room in most homes; TV viewing is a dominant part of most people's leisure activities and daily lives; and, for many, TV has become their most important source of information and entertainment. To say that TV has a central place in our culture, or that TV over the past 50 years has thoroughly changed our daily lives, leisure, patterns of consumption – and thereby our society – is, therefore, a statement that barely begins to describe reality (cf. Jensen and Toscan: *Interactive Television. TV of the Future or the Future of Television*, 1999).

At the same time, the World Wide Web and Internet access in the home have experienced dramatic growth rates in the last couple of years. While it took the telephone 74 years and the radio 38 years to reach 50 million users worldwide, and it took the extremely successful medium, television, 13 years to reach 50 million users globally, it has only taken the World Wide Web 4 years to reach a similar number of users. The penetration rate of Internet access in the home is now, to take a few examples, 52,2 percent in Denmark and 52,0 percent in the U.S. (CyberAtlas January, 2001), and the online population pasted the 400 million mark a year ago (Nua Internet Surveys, Nov. 2000). It appears as if the Web will be the next major medium delivering content and services – information, entertainment, etc. – to the home.

One aspect of this development is the convergence of television and the computer, the convergence and integration of Internet and broadcast, of Web and TV, of push and pull media. However, whether broadcasting will absorb the Internet in the form of Internet@TV, or the Internet will absorb broadcasting in the form of broadcasting@Internet, or, alternatively, the convergence will result in a completely new and unique communication phenomenon is, at the moment, still unclear.

The dramatic growth of Internet access in the home over the last couple of years and the massive and continued popularity of television necessitate a better understanding of how these two powerful media effect one another and how they can be used in concert as communication media. The aim of this paper is to describe and discuss various aspects of this ongoing process of transition and convergence.

Broadcasting Meets the Internet

There are several key trends, which, at the moment, bring the Internet and broadcasting together. At first many

broadcasters feared that the rapid growth of the Internet would draw audiences away from traditional broadcasting and lead to its eventual demise. This fear has now largely been substituted by a vision that sees broadcasters and content providers as perhaps those best positioned to turn the Internet growth to their advantage. The Web is no longer seen simply as a shop window where broadcasters must have a site in order to keep up with competitors. Instead many broadcasters believe that the emergence of packaging and 'channel' concepts on the Web means that broadcasters can now use the Internet as a valuable extra resource through which they can reach new consumers of their products.

Furthermore, as more and more ordinary people go online, the users of the Web are changing and, consequently, the online population will to an increasing degree show affinity to the audience of traditional mass media such as television, radio and film (cf. Jensen 2000b). In the same process – as a consequence as well as a cause – the content on the Web is undergoing dramatic changes. Actually, a couple of years ago a silent revolution occurred on the Internet. According to a report from Cyber Dialogue (Cyber Dialogue 1999), in 1998, for the first time, more users turned to the Web for entertainment content than for any other content type or service, such as news, product information, business information, health/medical information, shopping etc. (cf. Jensen 2000c). Consequently, the content on the Web, to an increasing degree, shows affinity to the content of the traditional mass media like television and radio.

In addition, Internet companies are increasingly using TV to present and sell their products and services, and correspondingly broadcast and cable networks are increasingly producing both TV and Internet content and managing their audiences in getting them to flow from one medium to the other. Thus, with media convergence approaching rapidly, it may soon be commonplace for user-viewers to move seamlessly from one medium to another on different delivery platforms or on the same delivery platform, be it TV or PC.

Trends in Collocated or Cross-Media Consumption

The segment of the viewers having access to the Internet is often referred to as the WETA population or the Web-Enabled Television Audience. There are now several international surveys focusing on the WETA population and the simultaneous use of TV and Internet, i.e. collocated or cross-media consumption.

According to Michael Tchong and Iconocast (2000b) 57 percent of all US Internet users have the capability to use their PC and television simultaneously. Of those, 86 percent actually go online and watch TV at the same time. This means that almost half of US home users are so-called 'multi-media-taskers'.

Findings from Cyber Dialogue's American Internet User Survey, or AIUS (AIUS is a quarterly survey that has been conducted since 1994 and consists of in-depth interviews with 1,000 Internet users and 1,000 non-users), carried out in the fourth quarter of 1999, show that 10,2 million US adults spent an average of 7.3 hours per week surfing the Net while watching TV. Two thirds of all time spent using both media was spent with the TV on in the background (Cyber Dialogue, 2000c).

A survey by Nielsen Media Research for American Online has investigated cross-media consumption in the U.S., or more specifically, TV viewing in Internet homes. The study based on data from May 1999 found that two in three Internet users, who have access at home are so-called 'active users', defined as users logging on to the Internet at least once a month. These 'active users' log on every other day on average (16 sessions a month) and visit about 12 unique sites. Coincidentally, this number of 12 unique sites is comparable to the number of TV channels actually viewed in the average TV home, which has not grown beyond 13, although the number of channels and viewing options available in the TV home continue to increase. This indicates that irrespective of how many TV channels or sites people have access to, they tend to stick to their favorites. The Internet surfers are slowly turning into Internet settlers. Furthermore, although thousands of sites are available, 90% of the Internet users visit at least one of the top 10 sites in a given month, a fact that points to the power of portals.

The study by Nielsen Media Research also found that television viewing in Internet households is significantly less than in non-online households, regardless of how long they have been online. On average, households with Internet access watch 13 percent less television than households without Internet access do. That works out to an estimated 32 hours less of television viewing monthly per household. Furthermore, the study found that television consumption in households new to the Internet is also lower. Households with Internet access for six month or less watch 10 percent less television than non-Internet households do.

However, while Internet households are lighter TV viewers than non-Internet households are, there are currently no indications that Internet access cannibalizes television usage. Analyses of the same homes before they had Internet access reveal that they were lighter TV viewers from the start. Thus, there is little evidence indicating that the Internet is directly effecting television viewing. Instead, the Internet offers a device to deliver targeted information, services and advertising to these lighter TV viewers. Most likely, this relationship between television and Internet usage will be further developed in the years to come.

Conformably, a survey by Bruke Information Communications and Entertainment Research from October 1999 found that Internet is not impacting TV usage. The study attempted to measure a direct and causal linkage between television viewership and Internet usage, but only 1.5% of the WETA population reported spending less time watching televis ion as a direct result of increased Internet usage.

The survey also investigated the linkage of television networks and their Web sites, i.e. the push-pull effect of transferring eyeballs between the two media platforms, TV and the Web, or the attach rate of a television network and its site. The survey showed that approximately two in three (66%) of the WETA population had visited a network's Web site to get more information about a program after watching the program. Conversely, 42% of the respondents reported that they had watched a television program after retrieving information on a network's Web site. Concerning the simultaneous use of TV and the Web, i.e. collocated consumption, the Bruke survey found that 39% of the respondents had been online at a Network's Web site at the same time they were watching a program on the network. This figure emphasizes the value that a web site can have regarding the on-air network. Overall, the figures indicate that customers wish some kind of TV-based interactive access to information and entertainment.

Returning to the Nielsen survey, the perhaps most interesting results are, that although Internet homes are lighter TV viewers, there are significant preferences in the types of shows and networks they watch compared to non-Internet users. Thus, people living in Internet households have a significant media consumption profile, i.e. they seem to consume media differently than persons living in non-Internet households (cf. Nielsen Media Research, 1999).

Findings from the NTA-survey

In Sept.-Nov. 2000, a group of researchers from VR Media Lab and Department of Communication, Aalborg University, Denmark, conducted a major survey in a local cable network, The Noerre Tranders Cable Network (NTA). The objectives of the survey were to investigate the use of interactive multimedia in the home, especially the use of TV and the Web, and to outline a profile of the new interactive user-viewer. The study included questionnaires, several qualitative group interviews with families using interactive media and, finally, video observations of collocated or cross media consumption in the home. However, in this paper, only some of the results from the questionnaires will be reported.

1,000 questionnaires were posted to members of the cable network, approximately 500 to ordinary subscribers and approximately 500 to technologically advanced subscribers, i.e. the so-called 'early adopters' of new consumer technologies, in this case indicated by the adoption of cable modems.

Findings from the survey show that, among the ordinary subscribers, 51 percent have access to the Internet, while 49 percent do not have access. This corresponds to the national average.

In the separate question: "How many TV sets do you have in the household?", 33 percent answered one TV set, 36 percent answered two TV sets and 23 percent answered three TV sets, while 8 percent had four or more TV sets. This implies that it is far more common to have two or more TV sets in the household (two thirds of the population) than only one. Asked about the number of computers in the household, 47 percent of the total population answered one computer, 27 percent two computers, 12 percent three computers and 3 percent four or more computers. Only 10 percent answered that they did not have a computer in the household.

Among the Internet households, 45 percent answered that they had access to TV and the Internet in the same room, whereas 55 percent responded that they did not have access to simultaneous use of TV and Internet.

Asked about the simultaneous use of TV and the Web, 12 percent of the WETA population answered that they watched TV and accessed the Internet at the same time every day. 24 percent said that they did this several times a week, 36 % said they did it at least once a month, while 57 percent said that they never watched television and accessed the Internet at the same time (cf. Figure 1).

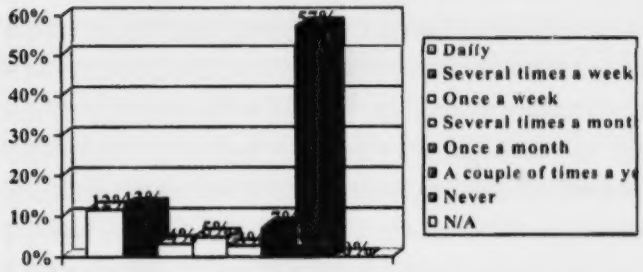

Figure 1. Simultaneous use of TV and Internet

Concerning the linkage of television and the Web, i.e. the push-pull effect of transferring consumers from one medium to another, the WETA population was also asked the question "Have you watched a TV program after getting information on the Internet?". A total of 8 percent of the Internet households responded that they did so at least once a week, 20 percent said that they did it at least once a month, while 60 percent answered that they had never watched a TV program after retrieving information on the Internet (see figure 2).

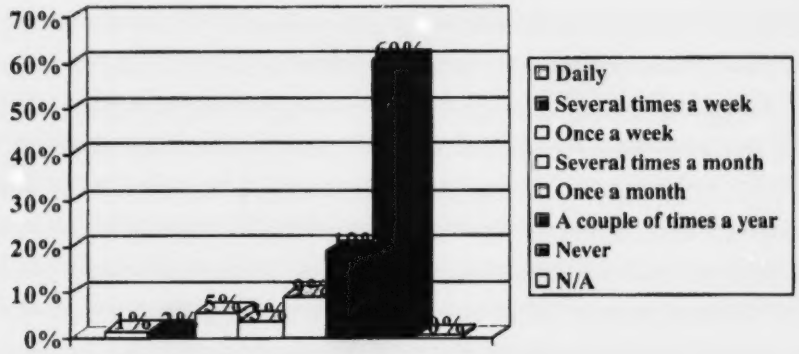

Figure 2: Watch TV after retrieving information on the Internet

In a separate question, which asked "Have you ever visited a site on the Internet after getting information in a TV program?", one third (33%) of the Internet households answered that they had never done it, 32 percent said that they did so a couple of times a year, while a total of 33 percent said they did it at least once a month. Of these, 15 percent reported that they did it several times a month, 6 % once a week and 3 % answered that they accessed the Internet on account of information retrieved from a TV program several times a week (cf. figure 3).

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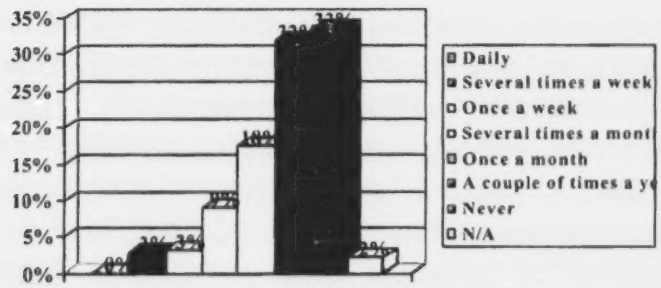

Figure 3: Visit sites on the Internet after getting information in a TV program

However, some of the study's key findings concern the consumer profile of the interactive user-viewer. Findings from the survey show that the WETA population, the interactive media users or the technologically advanced consumers, actually have a significant consumer profile with regard to media consumption of TV channels (cf. table 1) and with regard to program preferences (cf. Table 2). For example, if the criterion is, that the user has watched the given channel during the last week, we get the following distribution:

Table 1: Channels	**Non-Internet Households**	**Internet Households**
Discovery	50 %	63%
BBC Prime	14 %	23%
BBC World	12%	23%
CNN	26%	41%
TV Nord (local news)	85%	77%
DR2 (Public Service)	64%	77%

To cite an instance, while 25 percent of the total population have watched the Discovery Channel during the last 24 hours, the distribution between Internet households and non-Internet households is significant. 27 percent of the users with Internet connection responded that they had watched Discovery Channel during the last 24 hours, whereas only 17 percent of the subscribers without Internet access had tuned in to the channel. Correspondingly, while 63 percent of the Internet households had watched Discovery during the last week, only 50 percent of the have-nots had done so. Furthermore, while only 12 percent of the WETA population answered that they had never watched the Discovery Channel, a total of 21 percent of the have-nots responded that they had never turned on to the channel. As the chart indicates (cf. figure 4), it is possible to draw similar conclusions concerning the usage patters of other channels.

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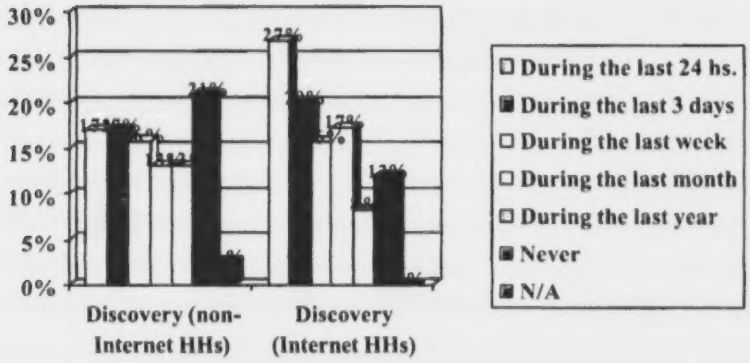

Figure 4: "When did you last watch the Discovery Channel?"

Correspondingly, as Table 2 illustrates, it is possible to draw comparable conclusions concerning Internet households versus non-Internet households with regard to program preferences such as news, documentaries, local news, sports, nature, quizzes, food, do-it-youreself or Home improvement, health, game shows, comedies and Si-Fi.

Table 2: Content Type	Non-Internet Households	Internet Households
News	64%	64%
Documentaries	32%	38%
Local News	50%	29%
Sports	24%	26%
Nature	20%	12%
Quizzes	12%	6%
Food	12%	8%
DIY & Home Improvement	17%	16%
Health	18%	7%
Game shows	24%	15%
Comedies	8%	19%
Si-Fi	4%	15%

Conclusions

There are a series of conclusions to be drawn from the arguments presented in the above

- simultaneous use of Web and TV, that is, collocated consumption or cross-media consumption, is a significant new media consumption pattern;
- the linkage of television and the Web, i.e. the push-pull effect of transferring eyeballs from one medium to another, is a significant new way of managing media audiences;
- people living in Internet households – the WETA population – have a significant media consumption profile, i.e. they seem to consume media differently than persons living in non-Internet households, among other things with regard to channel choices and program preferences.

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Acknowledgements

The paper presents results from an ongoing study, 'Multimedia in the Home: Media Convergence and Cross Media Consumption', conducted at the VR Media Lab (www.vrmedialab.dk) and the Department of Communication (www.hum.auc.dk), Aalborg University, Denmark, and sponsored by The Danish National Centre for IT-Research.

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Internet Usage Patterns in the Noerre Tranders Cable Network

An Empirical Study of the New Interactive User in a Local Danish Cable Network

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Abstract: According to a recent report by NetValue, Denmark has the highest proportion of households connected to the Internet at 54 percent, closely followed by the U.S. at 50.9 percent (March 2001). Given that Denmark now tops the home Net use, we can gain important knowledge of new trends in Internet usage and consumer preferences and behavior in Internet households by investigating Danish Internet households and users. This paper reports the findings from an empirical study of the usage of interactive technologies, such as the Internet and the Web, in a local, technologically advanced, cable network in Denmark, The Noerre Tranders Cable Network. The objective of the study was to describe and analyze the use of interactive technologies, services and content in the home, thereby drawing the profile of the new interactive consumer or user. The survey included questionnaires, qualitative interviews and video observations. The findings from the study have implications for the understanding of the users of the Web and, in general, the use of interactive networked media in the home.

Introduction: the NTA-survey

According to a recent report by NetValue (cf. Nua Internet Surveys, March 26, 2001), Denmark has the highest proportion of households connected to the Internet at 54 percent, closely followed by the U.S. at 50.9 percent. Given that Denmark now is in the lead regarding the home Net use, we can gain important knowledge of new trends in Internet usage and consumer preferences and behavior in Internet households by investigating Danish Internet households and users.

In November-December 2000 researchers from VR Media Lab (www.vrmedialab.dk) and the Department of Communication, Aalborg University (www.hum.auc.dk/index.uk.html) conducted a survey in a local cable network, The Noerre Tranders Cable Network (Noerre Tranders Antenneforening or NTA). The objectives of the survey were to investigate the use of interactive multimedia in the home, particularly the Internet, Web and other interactive media, and to outline the profile of – what could be called – the new 'interactive user or consumer'.

The study included questionnaires, a number of qualitative group interviews with families using interactive media, and finally, video observations of families using interactive technologies. However, in this paper only some of the results from the questionnaires will be reported.

The Noerre Tranders Cable Network (NTA) (www.nta-tv.dk) is a local cable network with approximately 10.000 subscribers in the eastern suburbs of Aalborg, the fifth largest city in Denmark. The cable network is comparatively advanced: it offers 35 channels in the basic service, plus additional services such as set-top boxes for digital services, including premium channels and pay-per-view, cable modems for Internet access, and – in the near future – IP telephony.

1.000 questionnaires were posted to members of the cable network. Approximately 500 to ordinary subscribers to the cable network's basic service and approximately 500 to subscribers to the cable modem service. In the study, the last-mentioned group is conceived as 'early adopters' of new technologies or as technologically 'advanced users' and, as such, is seen as representatives of the new interactive user. Close to 400 households responded to the questionnaire.

Findings: Technologies

Findings from the survey show that, among the ordinary users, i.e. the users without cable modems, 51 percent have access to the Internet (via ordinary modems), while 49 percent are non-Internet households. This corresponds reasonably to the national average of 54 percent Internet households (in March, cf. above).

Asked about the number of computers in the household, 47 percent of the total population answered one computer, 27 percent answered two computers, 12 percent three computers and 3 percent four or more computers. Only 10 percent said that they did not have a computer in the household.

In a related question, which asked "How many cellular phones do you have in the home?", 43 percent of the total population answered one, 27 percent answered two, 9 percent three, and 5 percent four or more cellular phones. Only 15 percent answered that they did not have a cellular phone in the home. This means that 84 percent of the total population have at least one cellular phone in the household (cf. Figure 1).

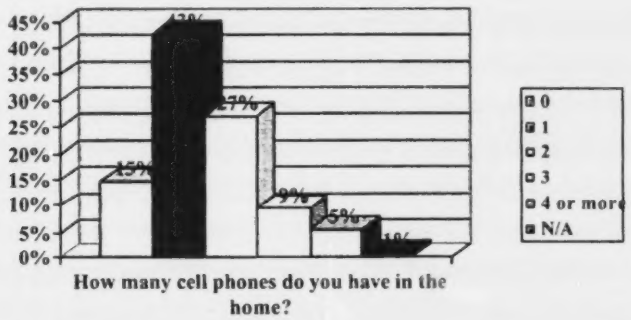

Figure 1: Number of cellular phones in the home

These figures indicate that we are dealing with a relatively advanced population with regard to new interactive consumer technologies, products and services. This conclusion is supported by data from several other questions in the questionnaire, which – due to limited space – are not reported in this paper.

Findings: Usage Patterns

The questionnaire also asked about the use of different Internet services such as email, chat, banking, and shopping.

The by far most used service is e-mail. In the separate question "When was the last time you used the email service on the Internet (from the home)?", 67 percent answered during the last 24 hours, 13 percent said during the last three days and 7 percent said during the last week. Only 6 percent answered that they had never used the email service (cf. Figure 2).

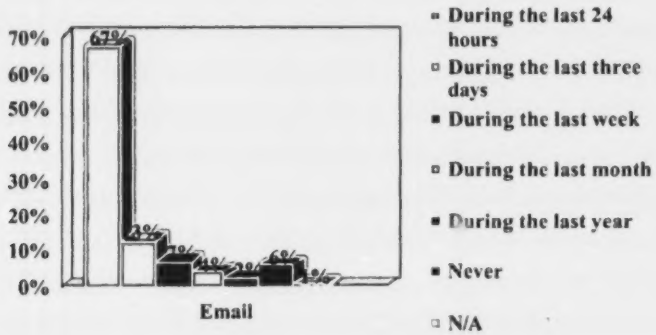

Figure 2: Use of Email

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In the related question "When was the last time you used a chat service on the Internet (from the home)?", only 5 percent answered during the last 24 hours. However, more than 1/3 (34%) answered during the last week, while nearly 2/3 (61%) answered during the last year. Surprisingly, very few – only 8 percent – said that they had never used a chat service (cf. Figure 3).

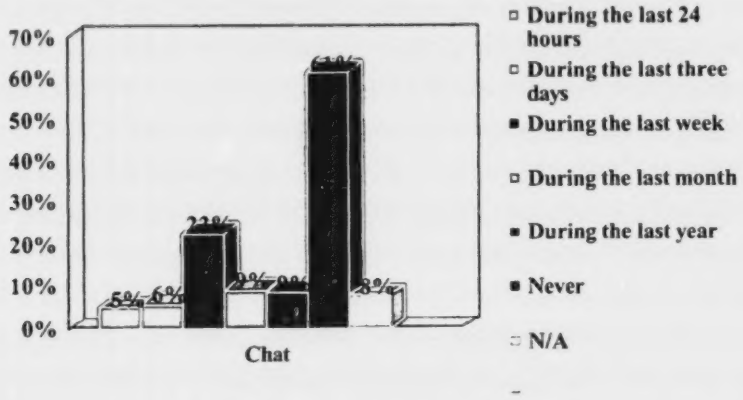

Figure 3: Use of chat services

Concerning services involving transactions, i.e. banking and shopping, the figures were considerable higher, compared to chatting. Just over 1/3 (37%) said that they had never used a banking service. 1/5 (19%) had done so within the last 24 hours, and another 1/5 (20%) had done it within the last three days. A total of 54 percent of the Internet-households had used a banking service on the Internet during the last week (cf. Figure 4).

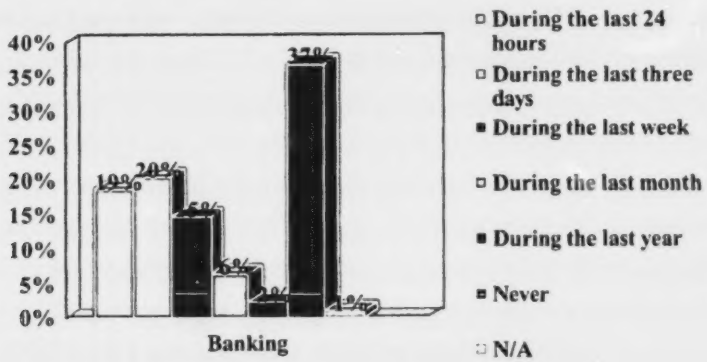

Figure 4: Use of banking services

In comparison, shopping on the Internet shows considerably lower figures. More that half (57%) of the Internet population had never used the Internet for shopping, only 1 percent had done so within the last 24 hours, and a total of 5 percent had done it during the last week. Just a total of 40 percent had used a shopping service during the last year (cf. Figure 5). Thus, due to, among other things, cultural traditions, shopping online is much more unusual in Denmark, compared to, for example, the United States.

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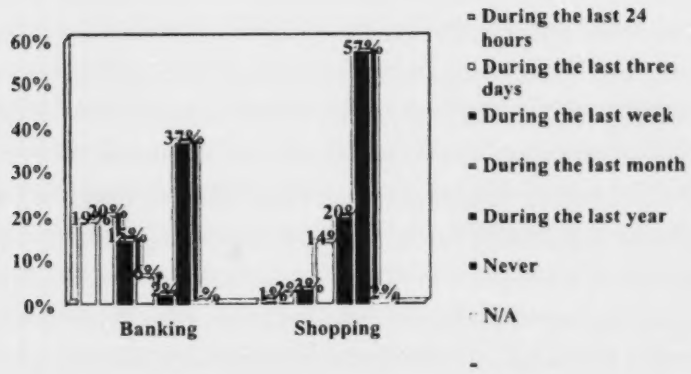

Figure 5: Use of banking and shopping services

Findings: Content Preferences

The study also investigated preferences regarding major content areas. A series of questions asked about the last time the user had sought information on a number of specific topics, such as news, sports, television, food, cloth & fashion, house & home, children & family, travel, health, technology, music, games and eroticism.

The by far most used content area was news. 27 percent answered that they had sought for news on the Internet during the last 24 hours. More than half (54%) of the Internet users had done so during the last week, while only 23 percent said that they had never sought information in the news category on the Internet (cf. Figure 6).

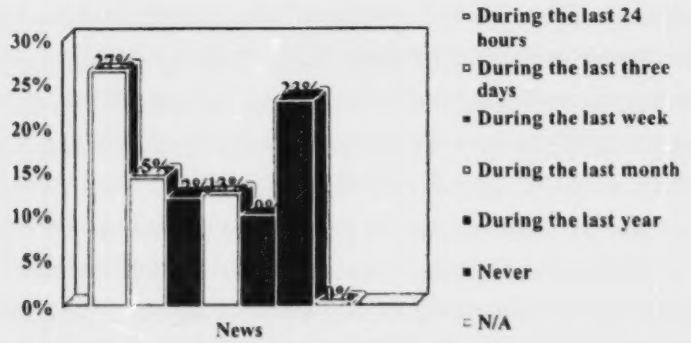

Figure 6: Seeking information in the news category

Other top scores among the content categories were technology and music. 15 percent said that they had sought information concerning technology during the last 24 hours, a total of 41 percent had done so within the last week. Less than 1/3 had never sought information on technology on the Internet. In like manner, 14 percent had sought information on music within the last 24 hours, while 36 percent had done so during the last week. Nearly 1/3 (31%) had never sought information on music (cf. Figure 7).

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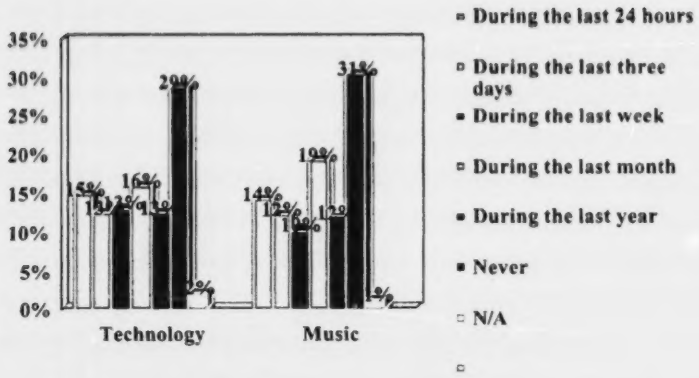

Figure 7: Seeking information in the technology and music categories

Other popular content categories were, not unexpectedly, sports and television. In the question "When did you last seek information concerning sports on the Internet", 1/10 (11 %) answered during the last 24 hours, while more than 1/4 (26%) had done so within the last week. Approximately half of the respondents (45%) had never sought for information on sports on the Internet. Information on Television shows comparable figures. Here 7 percent had sought information on television during the last 24 hours, while 22 percent had done it during the last week. 44 percent had never sought information related to television on the Net (cf. Figure 8).

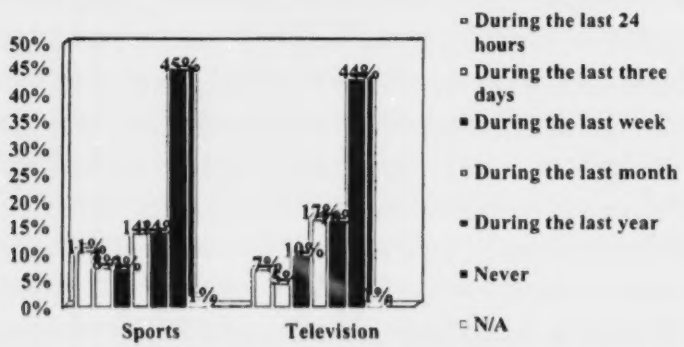

Figure 8: Seeking information in the sports and television categories

All other content categories show considerable lower scores.

If "During the last week" is taken as the decisive criteria, we get the following distribution of the content areas. Here clearly News (54%) and Technology (41%) are the most popular content areas, followed by Music (36%), Sports (26%), Games (25%) and Television (22%). Among the least popular content areas – below the 20 percent mark – are Food, Travel, Health and Eroticism (all 14%), House & Home (10%), Children & Family (6%) and Cloth & Fashion (5%) (cf. Figure 9).

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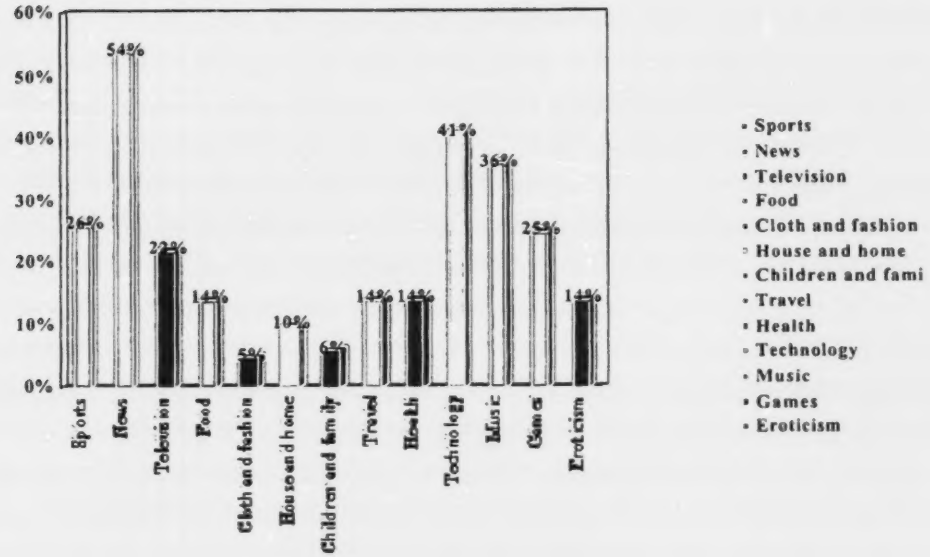

Figure 9: Content categories sought 'during the last week'

Conclusions

The findings from the study give clear indications of the consumer technologies, services and content areas preferred by the Internet enabled population. Consequently, the study has implications for the understanding of the users of the Web and, in general, the use of interactive networked media in the home. In this way, the data material from the survey may contribute to outlining the profile of the new interactive user of the future.

However, some of the study's most interesting findings are the significant differences in the user profiles and preferences regarding the technologically advanced households versus the ordinary subscriber households. Comparing the data from the two major groups of respondents – the cable modem-households and the non-cable modem households – the study shows that the early adopters of new technologies – in this case, cable modems – actually have a significant profile with regard to consumer technologies in the household, content preferences and media consumption. Unfortunately, due to limited space, these findings can not be reported within the scope of this paper (for further information, see Jensen 2001).

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Bridging Individual Experiences to Organizational Knowledge: The Remodeling of a National Learning Resources Center

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Abstract: To help students gain a robust and in-depth learning of knowledge, skills, and attitude within multiple disciplines, the "K-12 Gas Station" plays a critical role in the efforts of building up a technology-based learning environment. Based upon astonishing results of an action evaluation of this website a series of complete and precise suggestions on the revision of the website were made by the authors. To transform the "bulletin board" oriented web site into a "learning community" oriented virtual center, the remodeling builds up new community-support features, such as, resources and information sharing mechanisms, challenge activity platforms, database servers. All web users could build learning as well as teaching resources on the K-12 Gas Station learning community through constructing content which is contributed out of his/her own teaching experience. Remodeling rationale, structure and functions of new website and snapshots of the web forms the focus of this paper. Finally, the authors proclaim further suggestions for implementation strategies.

Background

To meet the needs of rapid changing society in this era, we have to produce technology literate citizens with competitive capabilities. It is a simple but difficult goal for educators facing the fascinating needs. Administrators and engineers seek to make Internet accessible and affordable for every classroom island-wide in Taiwan since 1994. Hence, offering up-to-dated and flexible learning resources becomes a major focus for virtual learning resources center of the Ministry of Education. The Ministry of Education has invested billions in wired campus, courseware, and teacher training for internet-based classrooms in K-12 schools. The "K-12 Gas Station" (http://content.edu.tw/; Figure 1) is the national website as the educational portal which provides teachers, parents, pupils, and public communities with rich content for all subject matters in grades K-12.

In 1997, the Ministry of Education selected over 250 teachers from eighty elementary and middle schools to design and produce web-based materials on the web. The whole project was overseen by a nine-professor steering committee and managed by a leadership team of seven government officers. However, The actual effectiveness or impact of such diligence is now generally considered suspect (e.g., Wu et al, 2000).

An action evaluation of this project was held between Feb. 2000 and Dec. 2000. The evaluation Data from focus group interviews, questionnaires, e-mail communications, conversation, meetings and observations with over 130 elementary teachers and administrators, government officers as well as scholars revealed that the whole project should make a sharp turn. Discussion among these subjects covered the important issues of vision, quality of web site, structure of the website, functionality of the web, learnability of web materials and capabilities of teachers. The major barrier of of the "K-12 Gas Station" website are vague vision, wimp website, incompetent involvement, rare resources, misjudged needs, to name a few (Jih, 2001).

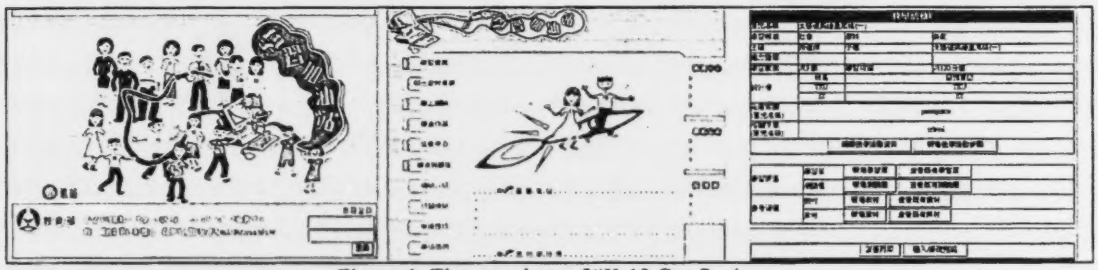

Figure 1 The snapshots of "K-12 Gas Station

Remodeling of the Website

The remodeling of the website is an in-time reaction to the findings of an action evaluation. To solve major problems of current "K-12 Gas Station", the researchers have made complete and precise suggestions on the revision of the website in terms of hardware, platform, courseware, and humanware via learning community perspectives. A comprehensive reform of the structure and function of the website as well as design and development of learning material is under going. This reform has been characterized as quality oriented, deep, total solution, and serious as described at following section.

From Individual Experience to Community Knowledge

Users play as active members of the teacher community is the key difference in the remodeling rationale. An "experience management" architecture was used to take place a "course management" system (Layton, 1999; De Boer, 2000). To transform the "bulletin board" oriented web site into a "learning community" oriented virtual center, the remodeling builds up new community-support features, such as, resources and information sharing mechanisms, challenge activity platforms, database servers (Linn & Burbules, 1993; Riel, 1988; Ryan, 1994). These new features would help building a knowledge base in which internal resources from change agents in the eLearning Project and the Ministry of Education, external resources from teachers, students, and parents, and recreated resources from existing materials are available for re-use in various integrations for different educational usages at a variety of locations. Therefore, all K-12 teachers, the primary users of the web, could build on the K-12 Gas Station learning community through constructing content which is contributed out of his/her own teaching experience.

Web Structure and Functionality

The new K-12 website features a tabled format and pulls all resources together into a single wizard-like interface, assuring web-pages authoring is a set of mouse clicks. The architecture of New website is three tiered. It encompasses a database on the back end and a web server interacting with the New K-12 website application (written in object-oriented Java) in the middle, accessible by a browser on the front end. The new web server utilizes a relational database supported by Microsoft SQL Server and Oracle. Major modules include eMaterials Management module, eClub Communication module, eCourse Searching module, Promotion Activity module, Online Voting module, Community Management module, Performance Assessment module, Information Broadcasting module, Monitoring module, and Member Management module (Figure 2).

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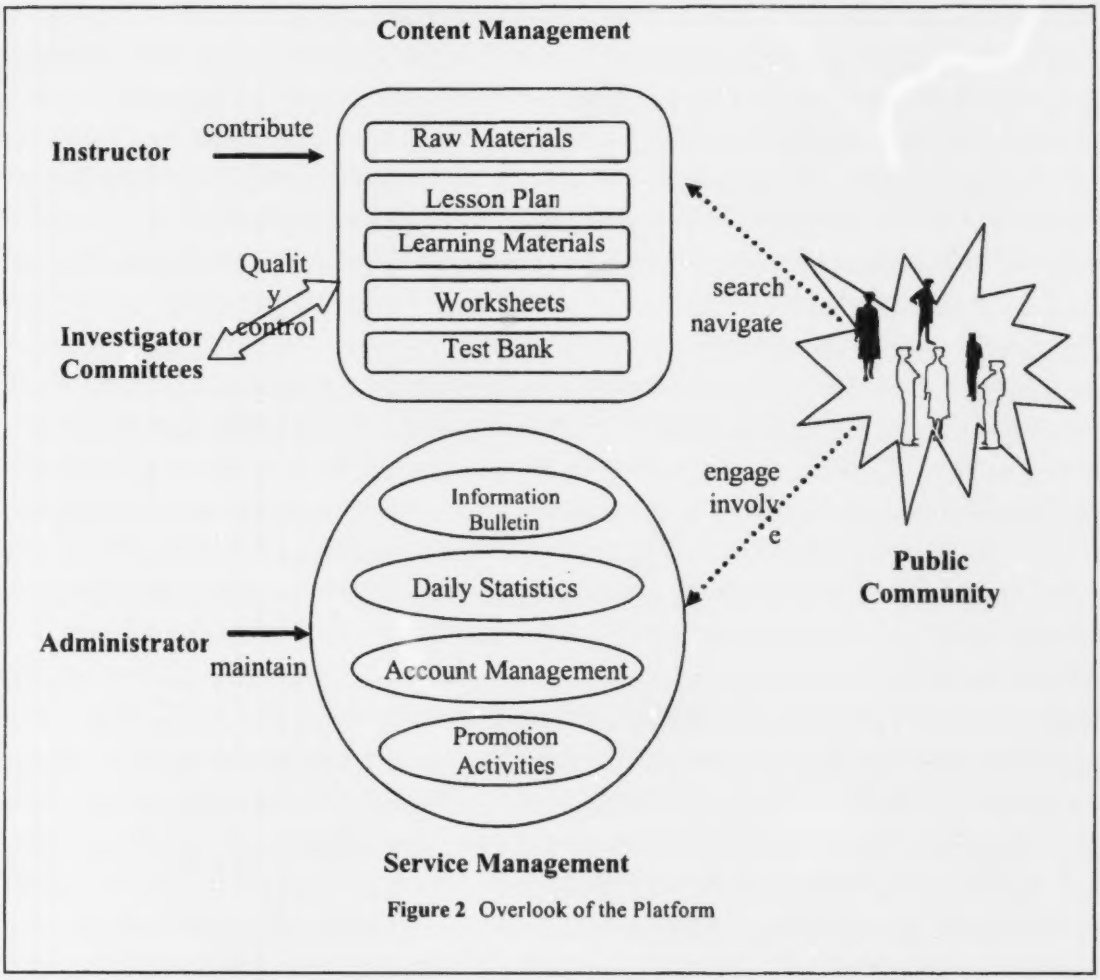

Figure 2 Overlook of the Platform

Through easy-to-use course Web sites, instructors, and instructional designers can make learning materials available to students anytime and anywhere. Following core features and functionality are included in the website:

- Community-building and organizational management
- Lesson/course development and management tools
- Communication and collaboration capabilities
- System/website (remote) management
- Relational database at the domain and/or topic management level.
- Content can be authored on PCs running Windows 95/98/NT
- Standard XML for content creation
- No HTML knowledge required to develop course/quiz material
- Multiple assessment methods (cf., multiple choice questions, True\False questions, Matching questions, Short answer questions, and Essay questions with multimedia format) can be created\scored with platform's authoring templates
- Question database for management of test questions
- Reporting features for test questions
- Investigating stage for quality control before making any materials live to students
- Automated information broadcasting
- User access and progress data available

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Follow simple, step-by-step process, contributors upload eContent items directly through a form-based interface or incorporate existing instructional content by uploading the files/folders into the web site (Figure 3). The system will then create folder structures to organize content automatically. A variety of uploading file formats (for instance, Microsoft Office, Adobe Acrobat PDF, HTML, digital images, digital audio files, digital video files, Flash, Shockwave, Authorware, etc.) are supported by the server system with XML format architect.

Teachers, students, parents, faculties, administrators, subject matter experts, community members and visitors are members of the virtual community. All users can see news, events, activities, and ranking list from multiple eCourse in one aggregated view. They also could view a comprehensive material listing and browse viewer-accessible courses through the course catalog.

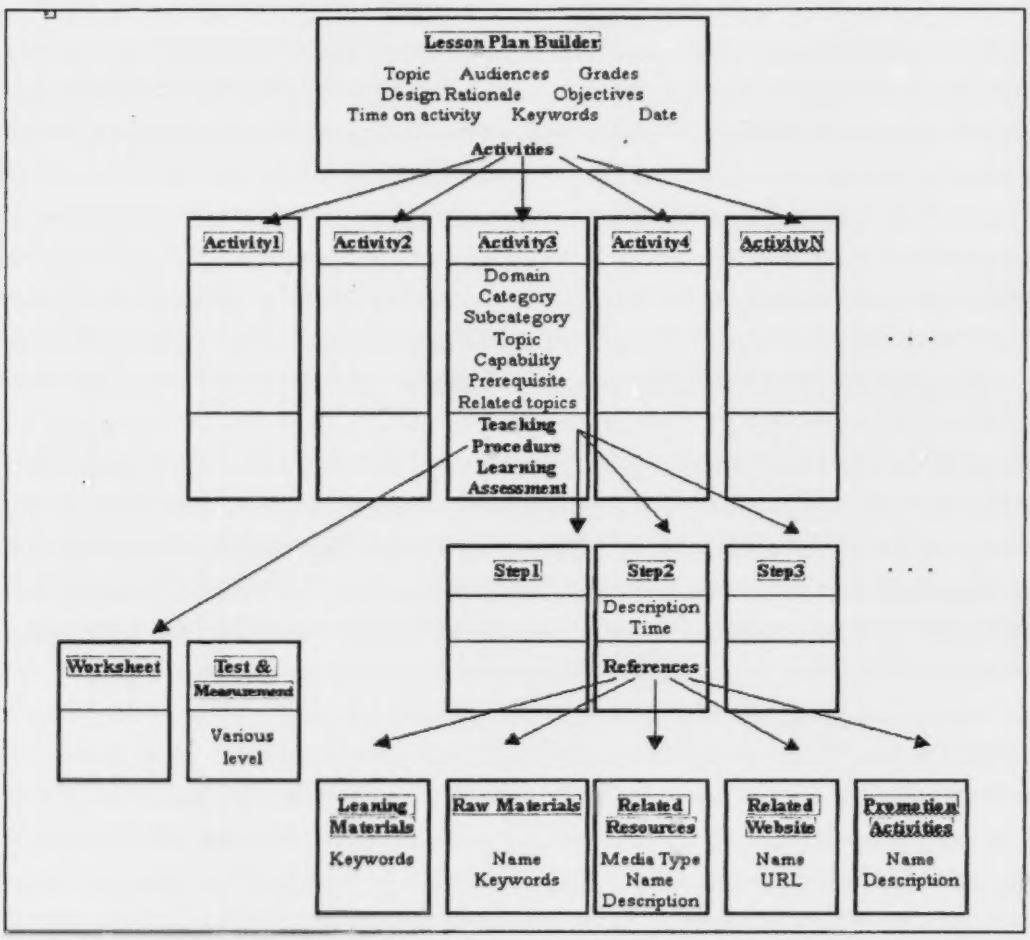

Figure 3 The Process of Lesson Plan Builder

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Conclusion and Future Work

"The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn." --*Alvin Toffler*

No web site is perfect, but some get closer. The remodeling of K-12 Gas Station is a remarkable reform for the computer-based education in Taiwan. However, designing and developing a better even perfect virtual leaning environment is not enough to guarantee the success of the effectiveness and learnability of e-materials on the web. Pupils as well as teachers could benefit from technology-based learning environment when technology is well planned, properly integrated with learning processes, and fully supporting students as they actively engage in constructing an integrated understanding (Bialo & Sivin, 1990 ; Kearsley, 2000).

Teachers, administrators, parents, and community professionals, have a vital role to play in educational reform. They need the following supports: need a transformation model rather than a transmission model, need pedagogical strategies, need appropriate infrastructure and computer resources and need to model strategies, give guidance and feedback, allow for revision (Krajcik, 2000). It is only when we make explicit use of new natures of learning technology that the new media would add multiple value to human learning of any subject. Many challenges to effective design remain in quality rich learning environments (Jonassen, 2000; Jonassen et Al., 1998).

Acknowledgements

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LEARNING ORIENTATIONS IN UNIVERSITY WEB-BASED COURSES

EDWARD R. JONES † AND MARGARET MARTINEZ ‡

ABSTRACT. This paper examines the research question of whether the distribution of learning orientations among university students enrolling in web-based courses differs from those in the general student population. Using the Learning Orientation Questionnaire (LOQ) [7] statistically significant differences in learning orientations were found between science students in a web-based course and those in a more traditional classroom setting. The implications of this finding on sample bias in educational research studies of web-based courses and on the instructional design of university web-based courses are discussed.

1. INTRODUCTION

Today, stimulated by legislative and educational initiatives designed to encourage development of web-based courses, an increasing number of web-based courses are being offered by universities. Increasingly, students have a choice of whether to include web-based courses in their selection of classes. Many are preferring to enroll in traditional courses rather than web-based courses.

If students attending web-based courses are atypical, then the results of educational studies of these courses are subject to sample bias. This raises the possibility that current characterizations of university web-based courses may not scale to larger, more traditional student populations. A key research question is whether today's web-based students are typical students, with typical learning orientations, or whether they differ from the general university student population.

Answering this question is important for several reasons. Increasingly, some university courses are offered only in a web-based format. This is particularly common among speciality, upper-division, low-enrollment courses. For these courses, students may not have a choice to take the course in a traditional format. It is important that the design of web-based courses appeal not only to today's population of web-based students, but also to a broader student population who may not have developed effective study habits for web-based learning.

This paper describes the results of research into possible differences between students in web-based courses and those who prefer to attend traditional classes. A new instrument developed for the instructional design of online courses, the Learning Orientation Questionnaire (LOQ), was used to quantify differences in learning orientations between students enrolling in web-based courses versus those who preferred a more traditional classroom setting. It was also evaluated as a tool for early identification of students at-risk of not completing the course.

2. BACKGROUND

One of the first widely reported studies of student performance in web-based courses was a randomized study conducted in 1996 by Dr. Schutte at California State University - Northridge. His remarkable claim that students in his web-based statistics course scored 20% higher than students taking the same course in a traditional setting was reported in the news [1]. As a result, a larger but non-randomized study was conducted at Texas A&M University Corpus Christi in an attempt to reproduce these results [4].

This second study also reported that students in the web-based class scored higher, although a closer investigation found that this improvement could be accounted for by differences in student GPA's [5]. It also found higher withdrawal rates in the web-based class than the traditional class. Since the study was non-randomized, students self-selected the course they wanted to attend. This

Key words and phrases. Instructional Design, Web-Based Classes, LOQ, Personalized learning, Learning Orientation Questionnaire.

Thanks to Dr. Mike Hardy for his assistance distributing the LOQ surveys.

TABLE 1. Learning Orientations (adapted from [5])

Learner Orientation	LOQ Range	Description
Resistant Learner	LOQ < 3.5	Resistant learners lack a fundamental belief that academic learning and achievement can help them achieve personal goals or initiate positive change.
Conforming Learner	3.5 ≤ LOQ < 4.6	Conforming learners are less successful online learners since they prefer highly structured learning environments.
Performing Learner	4.6 ≤ LOQ < 5.6	Performing learners are sophisticated students who are typically self-motivated and self-directed only in areas that they value. Otherwise, they rely on external support, e.g. instructors.
Transforming Learner	5.6 ≤ LOQ	Transforming learners are likely successful online learners with sophisticated online learning skills. They are highly self-motivated, self-directed, self-assessed and independent.

raised the question of whether the higher withdrawal rate might be explained by learning orientation differences between students in web-based courses and those in traditional classes.

To answer this question, the LOQ was used to quantify learning orientation preferences of students in web-based and traditional classes. The LOQ was originally developed to help tailor online instruction by identifying learning orientation preferences among students [6]. It consists of 25 Likert scale questions which can be answered in 10-20 minutes. LOQ scores range from 1-7, and are used to classify learners into one of four categories, see Table 1.

It is important to understand the difference between *learning orientations* and the more commonly used term *learning styles*. Learning styles is commonly used to describe a construct that considers cognitive factors as the dominant influence on how people learn differently. This traditional construct generally subjugates or overlooks the impact of emotions, intentions, will-to-succeed, and social factors on learning. In contract, the LOQ identifies a student's learning orientation. Learning orientations reverse the construct of *how people learn differently* to the dominant influence of affective, conative, and social factors on learning.

This is a key difference between traditional and online classes. In a traditional classroom good teachers instinctively manage differences in learning orientation, i.e., differences in intentions, motivation, etc. In this environment, it makes sense for classroom teachers to focus on learning style rather than orientation. However, it is much more difficult to influence these factors in an online course, where we are asking students to learn or their own. The problem of *self-motivated, independent, and self-directed learners* becomes an obstacle to learning and success in online courses.

3. Learning Orientation Comparisons

In this study, the LOQ was administered to 56 university science students taking an introductory course in statistics. Thirteen of them were enrolled in a web-based course and the remainder were enrolled in a traditional version of the same course. The percentage of students in each of the four learner categories is shown in the following distribution of learner orientations:

Resistant	Conforming	Performing	Transforming
0%	23%	57%	20%

In this general population of science majors, the majority are classified as performing learners, with almost an equal number of conforming and transforming learners.

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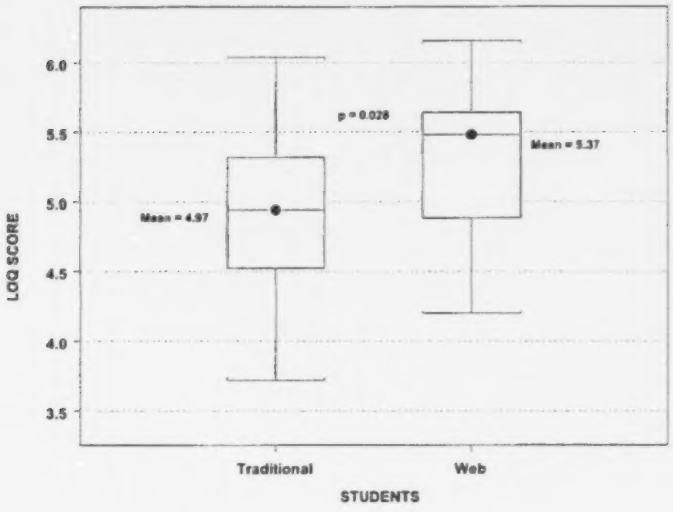
FIGURE 1. LOQ Scores for Traditional vs. Web-Based Students



The question of whether students deciding to enroll in today's web-based courses have a different learning orientation from those in the general student population is answered by these data. In this study, the average LOQ for students in the web-based statistics course was statistically significantly higher than similar students in the traditional version of the same course, see Figure 1. An examination of the learning orientation distribution between the web-based and traditional classes found that 93% of the students in the web-based class were either performing or transforming learners, see Figure 2. This is much higher than the same percentage for the traditional class, where only 68% of the students in the traditional class were performing or transforming learners.

Higher LOQ scores for students in web-based courses has important implications for the design and management of university web-based courses. First, it emphasizes the point that instructors can not just transfer their course materials to online courses and expect to be successful, without addressing the fundamental issues of student learning orientation in the instructional design of their online course.

This is not to say that every online course must have three separate learning environments, corresponding to the three major learning orientations. The instructional design of online courses can be developed under a single environment that offers a streamlined interface for conforming learners, and more advanced user interfaces for performing and transforming learners. Similarly, the content design can be offered it its entirety to conforming learning, a subset to performing learners and an even smaller subset to transforming learners.

The second important finding in this research is that the general student population includes a higher percentage of conforming learners. This suggests that instructors should not expect their web-based course to be successful with a general student population. Higher LOQ scores for our current web-based students indicates that the most successful web-based courses today are those designed for performing and transforming learners. On the other hand, web-based courses being developed for a broader student population must be designed to support conforming learners from the general student population.

Dr. Martinez discusses the instructional design implications as a function of the student's learning orientation [7]. Table 2 summarizes some of the suggested design considerations for the top three learning orientations. In general, Conforming Learners have a better chance of succeeding in an online course that is highly structured, providing detailed guidance, step-by-step assignments and

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FIGURE 2. Learner Distributions for Traditional vs. Web-Based Students

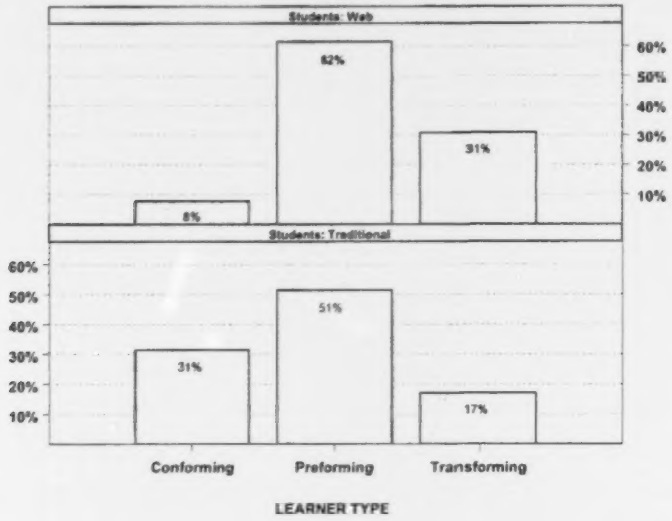

TABLE 2. General Instructional Design Considerations for the Three Major Learning Orientations

Orientation	Preferred Instructional Design
Conforming Learners	Courses with structured, guiding environments that help students avoid mistakes. Prefer less self-directed learning, simple step-by-step assignments, and guiding instructors. Course should provide explicit feedback with longer, focused and detailed guidance.
Performing Learners	Courses that are semi-structured, coaching environments that provide creative interactions. Prefer some self-direction in areas of high interest, task-oriented assignments which are somewhat challenging, and coaching instructors. Course should provide concise feedback with medium or brief guidance. It is important to focus on practical applications, and use learning modules of medium size that focus on applications.
Transforming Learners	Courses that are loosely structured environments that promote challenging discovery. Prefer self-directed goals and learning, challenging projects or case studies, and mentoring instructors. Course should be built around discovery and the freedom for students to design their own content structure. Learning modules should be short, concise and provide links to details, if needed.

focused guidance. In general, university courses tend to focus on developing general problem-solving, and knowledge, rather than skill development. Upper-level university courses, in particular, tend to be designed to incorporate some level of self-direction and exploration. A survey of today's university web-based courses would likely find that most of them follow the performing or transforming models described in Table 2.

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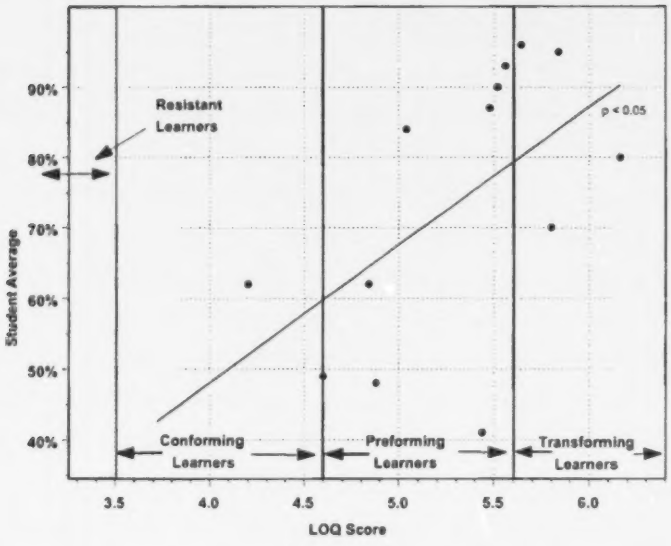
FIGURE 3. LOQ Scores versus Student Averages



Lastly, as previously mentioned , higher student withdrawal rates are being reported for web-based courses [5]. The final research question is whether student LOQ scores could be used to screen students enrolling in web-based courses to identify students at-risk of not completing the course.

To evaluate the usefulness of using student LOQ scores for screening students enrolling in online courses, the correlation between LOQ scores and the students grade was examined, see Figure 3. A statistically significant correlation between LOQ and grades was found, suggesting that LOQ scores might be used to identify at-risk students. This correlation suggests that student learning orientations should be identified before the course begins. Conforming and resistant learners should be identified and their course material tailored to their need for structure and guidance. They should not be expected to perform well on case studies and loosely structured projects. They will need more guidance and longer, detailed instructions for assignments and examinations. It may be even more important for them to be screened to ensure they have adequate prerequisites for the course.

4. SUMMARY & RECOMMENDATIONS

It is clear that today, that a new paradigm must be used when designing online courses. Courses developed for a tradition classroom setting should not be transferred to an online environment with consideration for the importance of learning orientation rather than learning style on the instructional design of web-based courses. The learning orientation distribution of students in web-based courses is different from the general student population. In particular, it appears that the current population of university students enrolling in web-based courses consist of more transforming and performing students than the general university student population. Moreover, since most web-based courses tend to be designed to encourage self-direction, exploration, coaching and mentoring, this study found a significant correlation between LOQ scores and student grades.

This suggests that LOQ scores can be used to design web-based courses by tailoring the content and user interface to the learner orientation of individual students. Ideally, the user interface, assignments, content and course structure should be adapted to match individual student learning orientations. There are an increasing number of tools for developing content that adapts to individual orientations [3, 2] stemming from research in adaptive learning.

In addition, this study found that LOQ scores can be used to identify students at-risk of not completing an online course. Instructors should identify students with low LOQ scores and ensure

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that they have the necessary prerequisites for the course. In some cases, they may need one-on-one tutoring and additional guidance from their instructor.

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Analysis of Postgraduate Student Contributions to an Electronic Discussion Board

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Abstract: When the postgraduate computer education program at ***** Institute of Technology was developed it was considered essential that it be accessible to students in full time employment. Consequently all classes are held at weekends and Blackboard Course Info is used to facilitate student-student and student-teacher interactions between classes. This paper outlines the structure of the program, profiles the students, explains the approach taken by the lecturers, and reviews the learning experiences of staff and students in two classes. It then goes on to analyse the contributions to the discussion board and the nature of the postings that took place.

The Program

The postgraduate computer education program at **** Institute of Technology was approved by the ***** in December 1999 and classes began in February 2000. Students may complete a Postgraduate Diploma, consisting of two compulsory courses and six optional courses, in one year of full time study (or the equivalent part time). The Master's degree requires four compulsory courses, and either three optional courses and a thesis or seven optional courses and a dissertation; it may be completed in two years of full time study (or the equivalent part time). At present the optional courses focus on networks, instructional technology, interactive multimedia, and the Internet.

Delivery Methods

To accommodate the needs of students in full-time employment, classes are held at weekends. Each course meets on four weekends, about a month apart, for four hours on Saturday and four hours on Sunday. The lecturers use a range of approaches (Joyce, 2000), including lecturer presentations, student presentations, group work, electronic discussions and individual communications (by email, telephone or face-to-face). The students complete three assignments per course, some as individuals and some in groups. There are no final examinations.

The Course

The course under review is called The Impact Of Information Technology On Society (referred to as 801 below): it explores past, present and future impacts and ethical issues. It was anticipated that few students would have much experience of exploring social issues, which made it very important that they have plenty of opportunity to discuss ideas and situations, both in class and between classes. For that reason, the lecturers reminded the students at all class meetings to use the discussion board to supplement face-to-face interactions (Joyce and Young, 2000). The course ran twice (once in each semester) with very different student groups.

The Students

In the first semester 801 class, the 16 students included five computing practitioners, five tertiary teachers, two secondary teachers, two technical support staff, a librarian and a sales representative. Four of them already had postgraduate qualifications, another five had bachelor's degrees, a further five had diplomas at various levels and the remaining two had extensive credits towards bachelor's degrees. All had significant practical computing experience (from six to 20 years) and all but four had English as their first language.

The second semester 801 class consists of 32 students whose first language is not English. Eight students already have postgraduate qualifications, one has an undergraduate diploma and the remaining 23 have bachelor's degrees, mainly in science or engineering. Not many had more than three years practical computing experience.

The Discussion Board in Semester 1

Two weeks before the first weekend meeting, the discussion board was initiated and students were invited to give some personal background and explain their interest in the course. Six students responded before the first weekend and seven more followed shortly after. Over the 20 weeks of the course active participation in the discussion board varied greatly (we can only speculate about the activities of "lurkers" - students who followed the discussions, but did not contribute).

Altogether 172 student contributions were made (an average of 11 per student). Some contributions were very brief (for example, asking for a definition, giving a URL or acknowledging a response) and some were quite extensive (for example, arguing a case or recounting an anecdote). The most active contributor (38 postings) was a computing practitioner with 15 years of experience. The next (25 postings) was a librarian. Only one student, a member of the institute's IT support staff, did not contribute at all. The biggest occupational group consisted of teachers (five tertiary and two secondary), who might have been expected to be major contributors. In the event their contributions ranged from one posting to 15. A further 14 postings were made by the lecturer.

It is interesting to review the number of times students accessed the discussion board during the semester (without necessarily making contributions). The total number of accesses was 5,645, the most from a single student being 1,173 and the least being three. There appears to be some correlation between accessing and posting, however it is difficult to draw any definite conclusions and certainly the student with the most accesses did not contribute significantly.

The Discussion Board in Semester 2

Altogether 128 student contributions were made (an average of four per student). The most active contributors (a computing practitioner from India and a recent graduate from Sri Lanka) made 13 postings each and three students did not contribute at all. A further 26 postings were made by the lecturer. When compared to the first semester course, the student contributions tended to be briefer (which might reflect the language skills of the students) and the lecturer tended to respond twice as often.

Although the semester 2 class was double the size of the earlier group, there were fewer accesses to the discussion board area with only 4,805. As average postings were lower for this semester, so were accesses to the discussion board, with only 25% of students accessing more than 200 times and 50% accessing less than 100 times.

Student Evaluations

At the end of each semester, students were asked to rate the usefulness of the different components of the course. When their responses were combined, scoring 1 for "not at all useful", 2 for "not very useful", 3 for "quite useful" and 4 for "very useful", the following rankings emerged:

Activity	Semester	
	1	2

Assignments	3.5	2.7
Books	3.1	2.2
Discussion board	2.8	2.3
Group work	3.2	2.0
Internet	3.5	3.7
Journals	3.4	2.7
Newspapers/clippings	3.5	2.7
Whole class activities	3.8	2.5

It seems clear that students in semester 1 valued their classroom interactions and various forms of print and electronic resources more highly than the electronic discussions. Comments about what they liked best included:

Discussions - expertise of lecturer and participants
Group discussions and participatory nature of the course

For the semester 2 group, whole class activities and group work were not as lively and effective as they were with the semester 1 class (possibly because of language), so it is not surprising that they were rated lower. However, the semester 2 class rated the Internet well above other resources, and it was the only component that they rated higher than the semester 1 class did.

Nature of the Postings

Having discussed the background of the two groups and reviewed the data regarding the number and frequency of access and postings, we will now examine the nature of the postings in more detail. The transcripts for both semester groups were analyzed and coded using Nud*ist qualitative analysis software. Through this analysis three distinct themes emerged in relation to the nature of the postings. These were the level of engagement of students in their posting, the focus on technological versus societal issues and the qualities of the posting itself. These three themes are expanded on below.

Engagement

Engagement describes the post in relation to whether it is initiating a new conversation, engaging other students (using such techniques as open questions, eliciting other opinions or being affirming) or is remote (in that it is merely a stated opinion of one person and makes no attempt to create dialogue).

A "getting started" topic was created in which students were asked to post information on their own background, history of IT usage, reasons for taking 801 and other relevant comments. In the first semester the majority of students posting both initial introductions and follow up comments did so in a way that attempted to engage their fellow students, for example:

Looking forward to hearing everyone's input to this fascinating area!
I am looking forward to learning more about this timely topic and meeting you all in the exciting discussion.
Look forward to meeting some new faces in the field.
I thoroughly enjoyed meeting you all on the weekend.

However, whilst this group maintained a distinctly polite and convivial etiquette they were equally comfortable challenging and questioning each other:

I agree that the value of the group is in the sharing of knowledge and other perspectives. Does this mean I think a group assignment is a good idea? Not sure.

For the second semester group, this forum was used quite literally as a way of introducing themselves; no discussions took place other than a very occasional affirmative response to a posting or a reply to a question, which was provided by the facilitator. The postings were more likely to be remote, providing information on self rather than acknowledgement of the group. One exception was that students of Chinese origin showed a greater tendency to attempt engagement. The semester one group were more likely to discuss their societal interests as much or more than their technological interests, or at least to ground their knowledge and background in a societal position. This did not occur at all for the second group, their focus being entirely on their technological background.

Technology Versus Society

Given that the title of the course was the Impact of Technology on Society, it proved interesting to review the content of the topic that focused on selecting a subject for Assignment 2 (the potential impact of an emerging technology on a sector of society). As we have already observed, the first group were much more likely to be interested in societal issues than the second group and this trend continued through this topic. Semester one students were more likely to place equal or greater focus on the sector of society than on the technology itself:

I think this will make an interesting study of learning styles, the politics of teaching (ie, do the teachers feel threatened by the new technology?).
I'm thinking about doing something to do with the visual arts. Not sure what technology to look at though the web and multimedia are obvious choices.
This time - to look at the corporate agency and the corporate client.
Business to Business is the obvious real impact of XML.
Libraries are one of the sectors likely to be affected by XML.

For the second semester group, the technology was paramount with little or no reference made to the sector of society to be studied:

I want to work on WAP for the second assignment.
I'm wondering if this startup can be my topic for my assignment.
I am planning to write about the new mobile phone standard UMTS which provides a broad bandwidth for mobile communication and offers opportunities for lots of new applications.
The topic will be MP3.

Posting Qualities

Postings for the Getting Started and Assignment 2 topics for both semesters were reviewed and the nature of the conversations was analyzed, allowing a number of categories describing the qualities of the postings to emerge from the data. This has led us to categorize postings as being one or more of the following:

Debating	Posts that raised questions or challenged previous posted comments or assumptions.
Facilitating	Posts that facilitate the direction, structure and nature of the discussion.
Participating	Posts that supported positions or opinions already stated or provided information requested (such as assignment topics) but which did not extend the scope or level of discussion.
Questioning	Posts that raised questions about the course processes and procedures or asked for further information on a specific subject.

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Ranting Posts which did not extend the conversation but appeared to be the author ventilating (often at length).
Resourcing Posts that provided resources useful for the group as a whole, sometimes in response to a specific question.

The most obvious difference between the two groups was the necessity felt by the course facilitator to provide guidance and facilitation via the discussion board. In semester one, the facilitator posted five comments in the getting started topic and three in the Assignment 2 topic, including the opening postings. These comments were just as likely to be participatory as facilitatory. In the second semester, the lecturer posted four comments to the getting started topic but fifteen to Assignment 2. These comments were much more likely to be offering students guidance on their assignment topics or answering specific questions related to process.

Whilst both groups were participatory, the first group were much more inclined to debate and posted considerably more resources than the second. The first group appeared much more informal and at ease with the medium, there postings appearing far more conversational than those of the second group. This could relate to a number of factors, including the experience and background of the main participants in the first group, communication difficulties for second language students as a limiting factor for the second group and the cultural background of the students.

A much greater number of postings for the second group were by way of making statements (this is who I am, this is what I will study) and only one topic appeared to engage the second group of students in debate. This related to a discussion of what was an acceptable subject (in terms of defining "emerging technologies") rather than a debate on the technology itself and resulted from one student challenging the facilitator, having being told that his subject was not sufficiently new. Second semester students were much more likely to ask questions of the lecturer in order to clarify requirements or to understand the process. The only discussion of this nature for the first group was related to group work and was aimed as much at the group as the facilitator (this topic would not have been relevant for second semester students whose induction process included greater emphasis on group work).

Ranting was not a common occurrence and did not occur at all for the second group. Only one student in the first semester posted messages that could be considered as personal rants. However, the posting of useful resources and the debates that followed, often allowing this student to take a "Devils advocate" role, often mitigated this.

Conclusion

From the study carried out we have concluded that the following factors were major influencers on the impact of the electronic discussion boards within the post-graduate program at ****:

- The willingness and ability of the course facilitator to create direction and their propensity to participate and create/expand on discussions.
- Culture and language appear to be barriers to posting and impact on the nature of the discussions taking place.
- A lack of interest in the societal issues and focus on the technical reduced the opportunity for dialogue in semester 2.
- Students require a commitment to electronic channels of communication (since the discussion board is passive and requires students to visit it in order to participate) and their contributions were greatly enhanced when this medium was already a familiar one.
- There was a lack of desire to create a "community" of learners by those who simply wanted to gain a qualification.
- No assessment component meant that the use of the discussion board was entirely optional (this ignores the question of whether or not an assessment component is desirable).

Similar conclusions have been reached elsewhere (Plumpton, 2000; Thomas, Weedon, Hall and Armstrong, 2000).

Given that the students were busy people (with many in full time employment), who only met as a group on eight occasions and were otherwise widely dispersed, the discussion board proved helpful in maintaining student-to-student communication between class meetings. The lecturers also used Blackboard Course Info to make electronic announcements (an average of one a week) to keep students informed (about logistics, resources and deadlines) and give general feedback about assignments. However it is clear from the student ratings and comments that they enjoyed meeting face to face and saw the electronic components of the course only as a useful support and supplement.

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Web Based On-Line Note Taking System (ONTS)

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Abstract: Online Note Taking System (ONTS) provides support for individual and group notes for a class. The system provides a web based interface to the notes and the note taking system. The notes are stored in a central database and are tied to course based web page.

Introduction

Online Note Taking System (ONTS) is a web based note maintenance system designed for use with class web pages. User ID's are supplied to individual users and groups. Each person can access their and their group's notes. The notes are tied to the URL's of the class web pages. This allows notes to be displayed with the corresponding information. In addition, the group support can allow groups to develop information or projects based on the individual sections of the course. Links to different chapters of a course are provided in the application. The concept is shown in Figure 1.

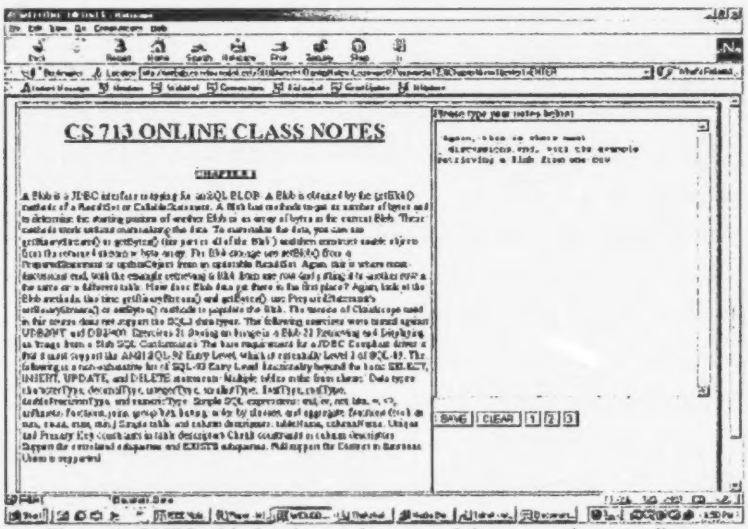

Figure 1: ONTS with the class web page and the personal notes editor.

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History

There is related work in 'Annotation Systems' and 'Groupware'. Though ONTS sounds like a hybrid of 'Annotation Systems' (Gramlich,1995, NCSA,2000) and 'Groupware', there is a fundamental difference in the concepts of each of them. Annotations are designed to add comments about an article published on net. Groupware (Olson,Teasley,1996) was designed for groups with members scattered over large geographic areas. Where as ONTS is designed for individual as well as groups with a specific aim of supporting online personal notes and to tie the notes directly to various subparts of the course materials. It is also designed to better support the types of group interactions found in a class.

ONTS Architecture

ONTS presents a web page, which runs a Java Servlet on the Web Server. JDBC is used to connect to the database. The database stores the information by user or group id. At the end of the session, the notes are saved back to the database. ONTS allows multiple levels of access to personal notes (with public access permission). This option enables the instructor to share student notes in class and discuss or comment on those points.

Summary

Online Note Taking System is a web-based technique, which allows students to take notes. The system synchronizes the notes and the class web page. This allows the students to naturally coordinate their notes with the class material. The notes are stored on a central database and can be accessed remotely from any web browser with Java plug-in. ONTS is simple and has low bandwidth requirements. ONTS provides flexibility to the students and diminishes the need for paper based notes.

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Interactive Visualization of Genetic Algorithm

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Abstract

This paper presents a sophisticated 3D visualization tool for Genetic Algorithms. GA's are evolutionary search method used to optimize systems. This tool aids the students in understanding the concept of Genetic Algorithm by visualizing their own program through a set of interconnected visualizations. It allows the viewers to examine and understand information by selecting various visualizations and navigating among the different visualizations. The user has control in selecting the particular visualization and options to highlight interesting parts of the information. Individual data items can be selected in each view. This selected data item will take the viewers to the same data item in the next view. Multiple selectable visualizations, parallel visualizations, a movie facility, and the interconnectivity among the various visualizations to aid the students in understanding their own GA problems.

Introduction

This paper presents a sophisticated visualization tool for the Genetic Algorithm (GA) technique. The objective of this tool is to help the students in an Artificial Intelligent (AI) class to understand AI techniques and their underlying process. It can be difficult for students to understand problems of AI. The Visual Program (VP) project has developed visualization tools for different AI problems. These visualization tools are used by AI students as an aid in understanding of AI techniques (Juell 2000) (Juell 1999).

Visualization Tool for GA

The tool provides a set of sophisticated interactive visualizations. This tool offers options to the user for choosing different types of visualizations. Each visualization represents the same information fom a different point of view. Instead of showing chromosomes, the points searched are represented as a points in three-dimensional space. One visualization contains all the search points. A red star marks the worst solution of each generation. Placing the cursor on a point shows information about the search point. There are parallel visualization capabilities. Clicking on a red star opens a new visualization in the lower frame containing all the search points of that generation represented by a bar chart.

Another visualization shows the minimum solutions. Placing a cursor on the search points opens a new visualization showing all the search points of that generation. A movie shows the steps of the search generation by generation. The movie shows two visualizations synchronized.

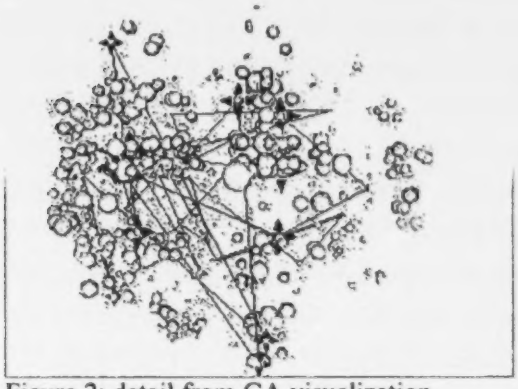

Figure 2: detail from GA visualization

Summary

This visualization tool aids the user to understand the search behavior of Genetic Algorithms. AI Students are using this tool to visualize their own GA program. It has multiple selectable visualizations, parallel visualizations, a movie facility, and interconnectivity among the various visualizations. These all aid the students in understanding their own GA problems. The tools are available at http://www.ndsu.nodak.edu/instruct/juell/vp and can be freely used, if credit is given.

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Use of ID Practices for User Interface Design: Needs Assessment, Needs Analysis, and Evolutionary Rapid Prototyping for a Family Health History Web Site

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Abstract: The World Wide Web is a rapidly growing medium for delivering information and education. The Internet is also an environment that is controlled by the user who can choose to go elsewhere in a single click. Effective interface and content design are therefore increasingly important. In this presentation, we describe how we integrated instructional design practices with usability design principles to create an interactive family health-history Web site, HealthHeritage.net.

Health Heritage

Health Heritage <www.HealthHeritage.net> has been funded by the Robert Wood Johnson Foundation to explore whether a web-based tool could:

1. Assist patients in recording and maintaining their family health histories in a secure, confidential manner, and
2. Support primary care physicians through analysis of health histories, identification of potential risks, and provision of health care recommendations.

To help ensure that this tool and resource will be useful to the intended populations, we implemented Instruction Design (ID) practices throughout the design and development of Health Heritage. ID is based on a systematic methodology for assessing needs and developing goals, analyzing the content domain and target population, and designing, developing and evaluating solutions (Dick & Carey, 1996).

Instructional Design Practices

The ID practice of needs assessment involves the acquisition and analysis of evidence that helps establish the needs and desires of members of the target population and from those having a stake in the success of the product. Needs assessments can take many forms, including interviews, on-site observations, focus groups, surveys, or analysis of resources such as documentation or standards (Kinzie, Julian, Davis, in press). The needs assessment for *Health Heritage* focused specifically on what the physician, patient populations, and our project stakeholders felt were most important. Stakeholders included medical specialists, geneticists, genetics counselors and informaticians. We also explored current family health history collection and explored existing methods for collecting, analyzing, and reporting similar types of data.

The needs data was collected in stages and analyzed using standard qualitative methods (Lincoln & Guba, 1985). A content analysis procedure was used to review the corpus of needs data, in order to identify themes expressed by respondents. Four major themes were identified:

- Goals/Assumptions for the Family Health History Project;
- Collection of Family History,
- Output of the Family History Tool, and
- Policy/Confidentiality/Security/Liability.

The ID practice of front-end analysis, involves breaking instructional goals down into component parts, or tasks, in order to identify the knowledge, skills, and information that must be learned, and the type of learning each task represents. The needs data are also considered to identify any characteristics that will affect the learning process. Similarly, in the design of *Health Heritage*, the themes that we identified were used to categorize the needs data in a conceptually clustered matrix, which enabled identification of the relationships between the themes and comparisons between the motives of the different respondent groups, the patients and the primary care physicians. This analysis led directly to specification of functionality for the web site.

Once the required functionality was identified through the needs assessment and analysis, we began the web site design following guidelines for good user interface design. (A complete listing is on the web: kinzie.edschool.virginia.edu/UIguide.html). Members of the user population participated in the design process through their evaluations of a series of evolutionary prototypes that were presented as paper-based blueprints of the design. The graphical interface, the "look and feel" of the site, was intentionally ignored until the functional and information requirements such as navigation and content placement were finalized. Undergoing numerous revisions, each version of the prototype brought us closer to the best possible user interface. Initially, for example, we had too many competing functions vying for user attention on each page. Through the evolutionary prototyping, we were able to identify and provide primary functions that guided patients in the creation of family trees and the recording of their family health histories and that provided patients and their primary care physicians with a series of easy to read pages that presented an analysis of health histories, identification of potential risks, and provision of health care recommendations.

We returned to the needs assessment and analysis data to develop the look and feel of the site and to create an icon that communicates the purpose and benefits of the Health Heritage tool. Several stakeholders including medical specialists, geneticists, genetics counselors and informaticians joined the design and development to in a creative brainstorming session. Here, we explored the concepts of metaphor and theme and selected those visual ideas that were most closely aligned with the desires of the user population and the features of the Web site.

The final stage of design and development followed with production of the Health Heritage Web site. This first Web-based prototype underwent a series of field trials with representative from the user population. The results confirmed the effectiveness of the functionality established through the paper-prototypes.

The resulting Web-site design was based on user population needs and on guidelines for effective user interface design. The design was refined as it was developed, through early user testing in an evolutionary manner using paper-based prototypes. This enabled significant evolution of the tool possible prior to software development.

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Preparing Content Providers for Homepages Addressed to People with Special Needs

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Our work is developing a homepage, content providers for and with people with special needs in a continuously evolving, participatory system we call capacitation. Our purposes are: qualifying technicians in Special Education, building, feeding and managing a site in the Web; considering concepts of design and ergonomics for people with special needs, as we develop a culture of computer. We took into account the following directives: being flexible, modular, so that, new participants may always be integrated; looking for accessibility resources both for the production of the homepage and the qualification of the work team; decentralizing the production of the homepage in form and content, and keeping a permanent channel for guidance of the participants; associating the qualification's content with its use in making the homepage; guaranteeing the work team's autonomy in keeping and improving the homepage.

Web-Based Instruction: A Paradox And An Enigma Of Instructional Paradigms, Pedagogy And Design Principles

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Abstract: If we look at the delivery of information and learning via web-based instructional systems we find some similarities to traditional learning, however we find more differences than similarities. We find that many web-based instructional systems do indeed make use of stimulants such as movies, sounds, and graphics. We also find that the best web-based instructional sites provide a reference library of sorts, to assist the student in their understanding of the material elements of the particular course. These reference libraries are usually hyper links to other educational or related web sites, which the student can use as a resource to further enhance their understanding of the materials. Some hyperlinks use video and animation to gain and hold the attention of the student, while others are merely "page turner" type of information sites.

But what of the interaction that takes place in the traditional classroom? What becomes of the theoretical arguments that an experienced educator would foster, stimulate, and encourage among the students and/or the educator? What becomes of the personality, fervor, and strength of conviction that normally results as a benefit of these stimuli? What becomes of the vocal intonations, inflections, and the facial expressions exhibited by the student? Are these qualities lost in web-based instruction? Can a chat session accomplish and achieve the finer points of theoretical argument without having the face-to-face stimulants and reactions that are readily apparent in a traditional classroom?

This paper will present the argument that on the basis of initial statistical information that in some cases web-based instruction is not succeeding, and in fact experiences substantially higher attrition rates than traditional class room instruction, with all other variables being equal.

Thesis Objective

The hypothesis of this paper is to present to the reader an argument as to whether existing instructional paradigms and design principles, philosophies, pedagogy, and practices require revision to effectively teach web-based instruction. Due to the length restrictions of this paper the reader is advised that not all paradigm's, philosophies, and practices are included, and those that are evaluated as to their usefulness in web-based instruction are very limited in scope, definition, and explanation. In all probability you will find that this paper will ask more questions than it answers, but in doing so will hopefully stimulate each of us to critically view and analyze the effectiveness of the current and prevailing practices employed in web-based instruction.

Background

As early as 1973 Daniel Bell, and later in 1980, the futurist Alvin Toffler identified several massive changes that our society has undergone: from the agrarian age to the industrial age, and now the information age. These futurists predicted a complete change in our societal values, and the reforms that would be necessary to accommodate the change from an industrialized to an information based society. In many cases, these

futurists were correct in their predictions, and our society today is indeed mired in the process of adjusting itself to accommodate this new age of information and technology.

In looking at our educational systems and the population of students that these systems serve we find quite a vast array of scope and difference among students. Demands upon and within the educational sectors are changing. For higher education, demographics and workforce changes are fundamentally altering the student population. In 1995, 44 percent of all college students were over 25 years old, 54 percent were working, 56 percent were female, and 43 percent were attending college part time. In a 1998 study published by the National Center for Education Statistics in 1997, more than 76 million American adults – 40 percent of the adult population – participated in one or more adult education activities, up from 32 percent in 1991.

Today a students' lifestyle and objectives are also very different than those students of yesteryear. It is not at all uncommon to find that today a typical student may be a single parent, who may be working two or more jobs to make ends meet in order to provide for their family. This same person may want to pursue a higher education, but may be unable to do so as a result of time commitments and constraints that are usually and traditionally required in institutions of higher learning. Additionally we find that many students do not have specific available time blocks, which they can reserve or allocate to a particular course or educational unit of instruction on a regular basis.

More students than ever before engage in learning programs that offer courses at nights or weekends. Some educational institutions even offer courses on Sundays – which in some religions could be considered sacrilegious! Schools have realized that in order to sustain themselves and to remain competitive they must adjust their offerings to accommodate this diverse and ever growing population of students.

As a result of newfound technological advancements in the fields of computer technology, education, and instructional technology, we find that web-based instruction is becoming somewhat commonplace in what would be considered traditional higher educational settings. Many schools now conduct a minimum of some type of web-based instruction. Additionally an entire new industry of web-based instruction has risen to compete with the universities in this endeavor.

In those otherwise traditional institutions where the implementation of web-based instruction has been implemented, the school is assisting the non-traditional student in the meeting of their educational goals and objectives. The school is also meeting its' own social obligation to educate even the most non-traditional of students. With the movement toward web-based instruction well underway, the question and thesis of this paper, is whether prevailing instructional and design practices are suitable to effectively support the non-traditional student in their use of web-based instruction.

Instructional Paradigms & Theory

A paradigm as defined in Webster's Encyclopedic Unabridged Dictionary of the English Language is an example serving as a model and/or a set of forms all of which contain a particular element...based on a single stem or theme. Therefore in extrapolating and interpolating the term instructional paradigm we could state that the definition would be a set of forms or examples of educational theory and practice based upon particular elements. You could in a broader sense regard this as the practice or pedagogy of instruction and/or design.

Probably the most noteworthy expert on instructional design paradigms is Robert M. Gagne, who authored the Principles of Instructional Design. Gagne bases his paradigms on the belief that instructional design efforts must meet intellectually convincing standards of quality and that such standards need to be based on scientific research and theory in the field of human learning. Gagne takes into consideration learning outcomes, including intellectual skills, cognitive strategies, verbal information, attitudes, and motor skills. He also considers the knowledge, skills, and abilities of learners and how the differences among learners affect instructional planning and design.

Behaviorism was a term coined by the American psychologies John Broadus Watson (1878-1958) in his paper, "Psychology as the Behaviorist Sees It." It is a theory of animal and human behavior holding that actions can be explained entirely as responses to stimuli, without accounting for the profound influences of interpretation on introspection. Thus an educator who believes in behaviorism would tend to attribute learning as a reaction to an event or action that would stimulate the student, but would be provided by the educator. To the behaviorist, teaching is essentially a matter of arranging contingencies of reinforcement so as to produce and maintain prescribed behaviors.

Constructivism is quite an opposite paradigm of behaviorism as described and defined above. Jerome Brunner first proposed the concept of constructivism in the mid-1960's and builds on earlier ideas of Jean Piaget. Basically, the theory of constructivism holds that the learner rather than the educator develops or constructs knowledge and that opportunities created for such construction are more important than instruction than that which originates from the educator. This is certainly not to state that there is not educator guidance or involvement, but that the student essentially will have a very strong voice in the selection and completion of tasks that will aid her in their learning approach to the given subject matter.

Web-based Instruction

If we look at the delivery of information and learning via web-based instructional systems we find some similarities to traditional learning, however we find more differences than similarities. We find that many web-based instructional systems do indeed make use of stimulants such as movies, sounds, and graphics. We also find that the best web-based instructional sites provide a reference library of sorts, to assist the student in their understanding of the material elements of the particular course. These reference libraries are usually hyper links to other educational or related web sites, which the student can use as a resource to further enhance their understanding of the materials. Some hyperlinks use video and animation to gain and hold the attention of the student, while others are merely "page turner" type of information sites.

But what of the interaction that takes place in the traditional classroom? What becomes of the theoretical arguments that an experienced educator would foster, stimulate, and encourage among the students and/or the educator? What becomes of the personality, fervor, and strength of conviction that normally results as a benefit of these stimuli? What becomes of the vocal intonations, inflections, and the facial expressions exhibited by the student? Are these qualities lost in web-based instruction? Can a chat session accomplish and achieve the finer points of theoretical argument without having the face-to-face stimulants and reactions that are readily apparent in a traditional classroom?

The correct response to these questions is that it depends upon the design of the course and the process of delivery that is used. If a web-based course is designed along the lines of the Gagne theory of instructional design, it could certainly achieve and accomplish its' objective. However while the elements of design are crucial and critical, so is the interaction of the students with both each other, as well as the educator. Regardless of how well web-based instruction is designed, if it is designed solely as a stand-alone product without any human interface or interaction it will, at the very least, not meet its' learning objectives or in the worst case, the ultimate goal to educate. Most students need interaction and human intervention so as to gain and experience the sociological elements of instruction.

The focus of a recent study by West Texas A & M University on the attrition rates for 15 graduate business courses offered on campus as well via a web-based instructional method reveals some interesting statistical patterns. During a three-year period beginning in 1997, it was convincingly found that MBA courses delivered via web-based instruction experienced a substantially greater attrition rate than did the same courses taught by the same professors in a traditional setting. The only variables between the two settings were the students and the delivery medium. The overall combined attrition rate for the web-based courses was a resounding 50% greater than the on campus courses, with several web-based courses experiencing an attrition rate of greater than 100% of those taught using traditional methods on campus! Some of the explanations of the higher attrition rates offered by the authors of the study include but are not limited to the following factors:

- Students were not able to adjust to the self-paced approach.
- The rigor of the study was greater than anticipated.
- Lack of student and faculty experience with web-based instruction.

Of particular concern and note is that courses in the various business disciplines that rely upon mathematics appear to be especially ill suited to web-based instruction. As an example a Statistical Methods course on campus experienced a 13% attrition rate, while its' web-based equivalent experienced an attrition rate of 43%, or greater than 3.3 times the attrition rate of the on campus course. A Quantitative Analysis in Business

web-based course experienced an attrition rate of 33% as compared to the same on campus course which experienced an attrition rate of 17%, or about half that of the web-based course! These differences in attrition rates should not and cannot be ignored.

In a survey of online teachers and learners recently prepared for the Project Steering Committee of the VET (Vocational Education Teachers) Teachers and Online Learning Project the report author indicates that there are several themes running through the comments that are cautionary. These include the need to ensure that the instructional design is correct, and that motivation concerns, as well as the difficulty and confusion of on-line users is taken into consideration during the design process.

Could it be that our quest to satisfy the masses and provide an educational forum for such a diverse audience is somewhat poorly designed or ill conceived? Could it be that the lack of human intervention or contact is a contributor to the causes of frustration and ultimately to the significantly higher attrition rates of web-based instruction?

In my own teaching experience in web-based instruction, I have found that even on the best graphically designed web site, the student needs and will actually seek out interaction with another student or the educator. This human intervention and interaction is crucially required of many students, but not all. Some students are perfectly content viewing and reading information from a computer monitor and learning in this way. But the two fundamental design questions remain: what is the objective of the particular course, and what is the desired instructional outcome? If these two questions do not include the learning of social interaction among culturally diverse students, have we not failed to meet our social obligation to educate?

To illustrate further I have discussed web-based instruction with Professor Margaret West, Ph.D. of Northern Illinois University. In any course in which Dr. West provides web-based instruction she insists on face-to-face class meetings at various points throughout the semester. This allows the students to interact not only with each other but also to be mindful of the humanness of the educator. It allows the educator also to view the humanness of the student, who may be shy, or intimidated by either the web-based instruction, or the human interaction with fellow students. In any event this human interaction provides a further development of the educational endeavor, and allows for the student to learn the intricacies of the social environment of learning.

In having the opportunity to bring to fruition a mix of the traditional class room environment along with a constructivist educational attitude, I believe that the student will learn a great deal more as a result of human intervention and interaction than when merely left alone at the web site to learn. The fact of the matter is that much of web-based instruction includes the ability of the student to engage in forum discussions with other students, and at predetermined times with an educator leading the course of discussion. Additionally in many web-based instructional settings the student can and does frequently send emails to the educator or other students. Fundamentally however, these interactions are not human interactions at all. These keystrokes are merely a very weak substitute for the actual human interactions that would readily take place in a traditional classroom setting and provide only for the instantaneous delivery of inquiries and work product.

Certainly there are numerous other theories of instruction that could possibly demonstrate arguments on either side of this thesis. As an example, lets briefly consider problem-centered learning, within the element of web-based instruction. One of the most noteworthy educators of our times, Dr. Thomas M. Duffy of Indiana University and Unext.com is a strong proponent of problem centered learning in a web-based environment.

While I certainly do not possess neither the education, the credentials, nor the experience to argue this point with Dr. Duffy, I believe that I can respectfully suggest at a minimum that problem centered learning on the web, may not be suitable to every student. Once again, without human intervention and the social implications and benefits that this type of interaction provides to the student, the student may eventually find themselves lost in their ability to intellectually and emotionally engage in the most simple of arguments or discussions.

Aside from the normal fears that some students have relative to their ability to function within a personal computer environment, what other fears may exist if we enroll this student in a web-based course to which she may possess little or no knowledge, and then "throw her to the wolves" using a problem centered scenario? I fully realize that even in a problem centered scenario there are on-line resources available to the student including chat forums, additional reference materials, and even periodic and timely assistance and feedback by the educator. However, without having any academic knowledge of the subject matter, coupled with these other fears within a problem centered scenario, with little or no in-person intervention available would appear to be a situation that would have a high likelihood of failing to meet the learning objectives of that particular course of study. Even if specific learning objectives were met and determined to be successful, have we not failed to provide the student the type of human interaction and socialization that may assist them overall in their particular vocation? Why would we want to place a student in the position of potentially passing a

course of web-based instruction, but not learn the art and beauty of social interaction and behavior coupled with intellectual stimulation and constructive argument?

On the positive side most web-based instruction does provide discussion forums, discussion groups, and e-mail capability. Collectively these various venues enhance the students' ability to write philosophically and intellectually. Using these forums will indeed enhance the educational benefit of web-based instruction, but not necessarily to the same extent that web-based instruction coupled with human interaction could or does.

Conclusion

The solution to the issue of designing an effective web-based instructional model lies in the answer to the following question. In which ways can web-based instruction bring both the best instructional process to the student, as well as bring about the convergence of a stimulating and encouraging environment of learning while also meeting learning objectives within a social environment? Is a shift in design and practice paradigms necessary, or are what we are experiencing merely a juxtaposition and congruency of the instructional design principles of Gagne, coupled with the principles and practices of either the behaviorist and constructivism approaches to learning?

Is or will it ever be possible for us as a society to provide the same type of interaction that takes place in classrooms via web-based instruction? If so, will we loose any of our abilities as educators, or will web-based instruction create more clearly defined challenges and obstacles to the educational process? Will web-based instruction be able to take advantage of alleviating distances between the masses while still being in a position to provide a quality education, or will web-based instruction fall by the way side as merely a technology fad that was temporary at best?

With only limited research or empirical data and/or analysis available on this topic or of the effectiveness of web-based instruction to accomplish learning objectives, we can all pontificate and engage in this type of hyperbole. However with the emergence of preliminary research as referenced earlier, there are strong indications that web-based instruction may not be achieving its' educational goals. What may be necessary is that a combination of the tried, tested, and scientific principles of instructional design and educational pedagogy must be employed in order for web-based instruction to succeed. Unequivocally, under no circumstances should proven instructional principles be sacrificed in order to serve the masses more efficiently.

In order for web-based instruction to succeed with the same or exceedingly difficult goal of increasing the benefit of the educational experience to the student, a new type of web-based design and instructional practices, principles, and pedagogy will emerge. A new type of instructional delivery system will continue to emerge and evolve as a result of technology advances and convergence in the way of high-speed video conferencing, tele-immersion, and real time conversations using a readily available and affordable high capacity bandwidth.

A new type of educator will also emerge. This will be an educator who has had the successful experience of teaching in a traditional classroom setting but is able to take advantage of the technology to bring forth a better delivery method of instruction within a web-based instructional setting. This will be an educator who believes that personal intervention within a web-based environment is not only necessary for the student, but also for the educator and indeed will provide a valued sociological benefit to both.

Is web-based instruction a suitable alternative for all subjects, for all students, and/or for all institutions? The unequivocal response to this rhetorical question is of course not. Each of us possesses certain behaviors, skills and attributes, which allows us to learn. We are as different in these processes as the night is from the day. Web-based instructional methods are only a single source utilized to expedite instruction. Some students will continue to use the services of a traditional institution, coupled with web-based instruction, while other students will be more suited to the rigors of a traditional classroom situation.

Will we require making a committed and concerted effort in a paradigm shift in order for web-based instruction to succeed? I am not certain that a complete shift in tried, and tested philosophies, paradigms, and methods is as necessary as is the return to the fundamental approach to education which is to recognize the uniqueness and differences in learning style's and learning patterns that distinguishes us as human beings, students, and individuals. Only with the acceptance of these learning differences can we as instructional designers, and educators utilize the technology resources to reach the masses. Only with this recognition of differences will we be in a position to challenge and to establish new paradigms of instructional design

philosophy. Only with the recognition of these differences will we establish and possibly redefine the instructional philosophies and practices, which currently exist within a web-based learning environment.

Time, experience, technology and the dedication of educators and students to attempt new methods of delivery and instruction will be one of the bases of foundations for any new or re-configured paradigms and/or instructional practices that may come into existence in the future. The evaluation of these success and/or failed attempts coupled with only the passage of time will eventually allow us to effectively evaluate the changes necessary to determine if a shift in educational paradigms, philosophies, dogma and practices are required to suit the information age, and more specifically web-based instruction.

It is imperative and essential that the reader understand that I am not as a professional just another contrarian opposed to web-based instruction. If web-based instruction is to be utilized as yet another delivery mechanism for instruction, it must be designed in accordance with instructional technology principles that take the humanness of both the student and the educator into full consideration. Ultimately if the human factor is incorporated into web-based instruction we as a society will have successfully merged technology with the human elements of communication to ideally suit a generation of students raised upon tried and proven principles of education, coupled with the use and the excitement of technological resources.

In any event, we as educators are very fortunate indeed to be involved on the "cutting edge" of a distance learning evolution and revolution! What an exciting opportunity for each of us to participate in the development and establishment of a new paradigm ideally suited to this new and ever changing technology as well as meeting the needs of the student and society. What an exciting time to be involved in the educational process and in the future development of intellectual stimulation, inquiry, and argument using advanced technology!

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Development of eTrip System: Collaborative Learning Platform for a Field Trip

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Abstract: *This paper describes the concept and implementation of a collaborative learning platform for school education over the Internet. We call this platform the "eTrip system" because we applied it to a school field study. Using information technologies, it supports the whole learning flow for a field trip: pre-trip learning, hands-on learning, and post-trip learning. It enables students to learn more effectively and more vigorously by providing them with a collaborative environment based on a "student-extended database" and "electronic bulletin board". We evaluated the system experimentally for a field trip by senior high school students.*

1. Introduction

It has been argued that students learn best when given the opportunity to learn skills and theories in the context in which they are used, and then construct their interpretations of the subject and communicate their understanding to others (Resnick, 1987). Therefore, field studies have attracted much attention because they give students that opportunity. In Japan, school education has been changing recently as a result of national policies which intend to introduce "integrated study" styles into the curriculum from 2002. "Integrated study" aims to help children develop the capacity and ability to discover problems by themselves and solve them appropriately. This notion is similar to the project-based curriculum in the United States.

With this change in education, the field trip in Japan has been changing, too. On a typical senior high school field trip, students used to go somewhere for about four days and three nights to learn with some specific purposes. Until a few years ago, these purposes were usually just to go sightseeing and add to their general knowledge, but recently they have tended to be to study and experience as part of integrated studies. Students explore some learning themes such as the culture and history of their destination before the trip (pre-trip learning). Then they go there and learn from various experiences (hands-on learning). After the trip, they put their thoughts together and present them to the class (post-trip learning).

With this background we have developed an eTrip system that supports the whole learning flow in the field trip with information technologies. This system enables students to learn more effectively by providing them with an environment for collaborating with other students. This system features a "student-extended database" and "electronic bulletin board" to extend learning opportunities. In this paper, we describe the concept and implementation of the eTrip system and report the results of an experiment.

2. Basic Design of the eTrip System: Collaborative Learning Platform

We think it is important for students to prepare a common learning framework with other students, teachers, or experts. In developing the eTrip system, we considered the following design guidelines to facilitate collaborative learning over the Internet.

1. Archive their learning and experiences and make them public
2. Share them with all students and understand them
3. Discuss vigorously with others and broaden their knowledge.

Figure 1 shows the concept of the system. This system uses a client-server model and everybody can access it via the Internet. Using the database, they can write reports about their learning or experiences and send them to the database easily using a template in a browser. They can also retrieve other people's reports and educational materials from the database by searching with some conditions such as the learning themes. Using the bulletin board, of course, other students, teachers, and experts can participate in this system and discuss with students. The database and the bulletin board are linked by each learning theme.

This concept is applicable not only to field trips but also to various types of problem-based learning. We have already developed an Internet-based content-growing encyclopedia, called "CyberPedia", which has been successfully applied to aquatic microorganism observation, periodical tree growth observation, and so on (Kura et al., 2001).

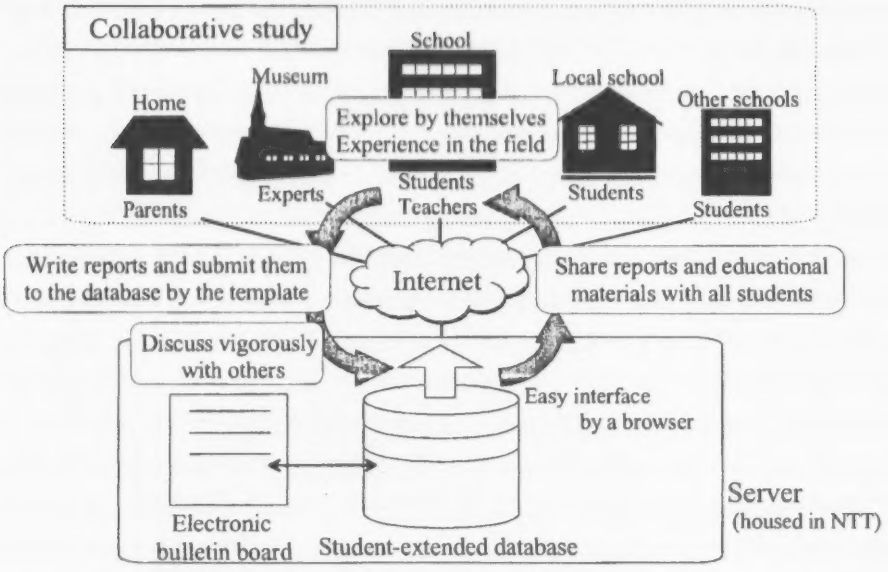

Fig. 1 Concept of a collaborative learning platform on the Internet.

3. Implementation of the eTrip System

3.1 Pre-trip learning system - collaborative learning process

The main purposes of the pre-trip learning are to explore the learning themes using the Internet or books in advance and to make plans for what to do at the destination. On Japanese field trips, students are permitted to perform free activities in groups of four or five. So, they plan their schedule by themselves according to the learning theme. Figure 2 illustrates an overview of the pre-trip learning system we developed. It has three main functions.

(1) Search for information in the database

This system works with most browsers and has a good structure that is easy to understand. This window consists of three frames. The left one is for specifying the search conditions, the middle one lists the search results, and the right one displays details of a result. Each result has some items such as learning theme, key-words, and locations and can be retrieved by them. The learning theme, for example, geography and nature, culture, and history, are registered by administrators beforehand. More detailed keywords, for example, coral reef and food or plant names, are registered by students. The results of the search are listed in the middle frame and are linked with icons on the map. The position data is very useful for students when they are making plans. They can also search for data by specifying areas on the map. The details of one result, for example, a reference URL and comments, are displayed in the right frame. Of course, we need some initial contents in the database, but not a lot by design, because the next function is to build up the contents.

(2) Submit reports to the database

Students can get some information from the database, but to get more details, they must seek it by themselves using the reference URL and various search engines. The most important thing here is to share the information that they find with all their fellow students. This sharing is a big motivation for students to study more. Each student enters the results of his/her studies into the database and other students can look at them from the database. So, we call this a "student-extended database". It is easy for students to submit to the database because all they have to do is fill out the template and click the submit button in the browser.

Our system does not make the students' data public immediately. Teachers can check and approve it in a browser before it is opened to the public over the Internet. In other words, teachers act as filters between students and the Internet. This confirmation work is rather a burden for teachers, but the benefit is that they can correct mistakes made by students before the work is put on the Internet.

(3) Discussion by electronic bulletin board

Electronic bulletin boards are set up for each learning theme. Many students at different schools and some experts can participate. When students have a question about local subjects before a trip, they can easily ask the students at a local school.

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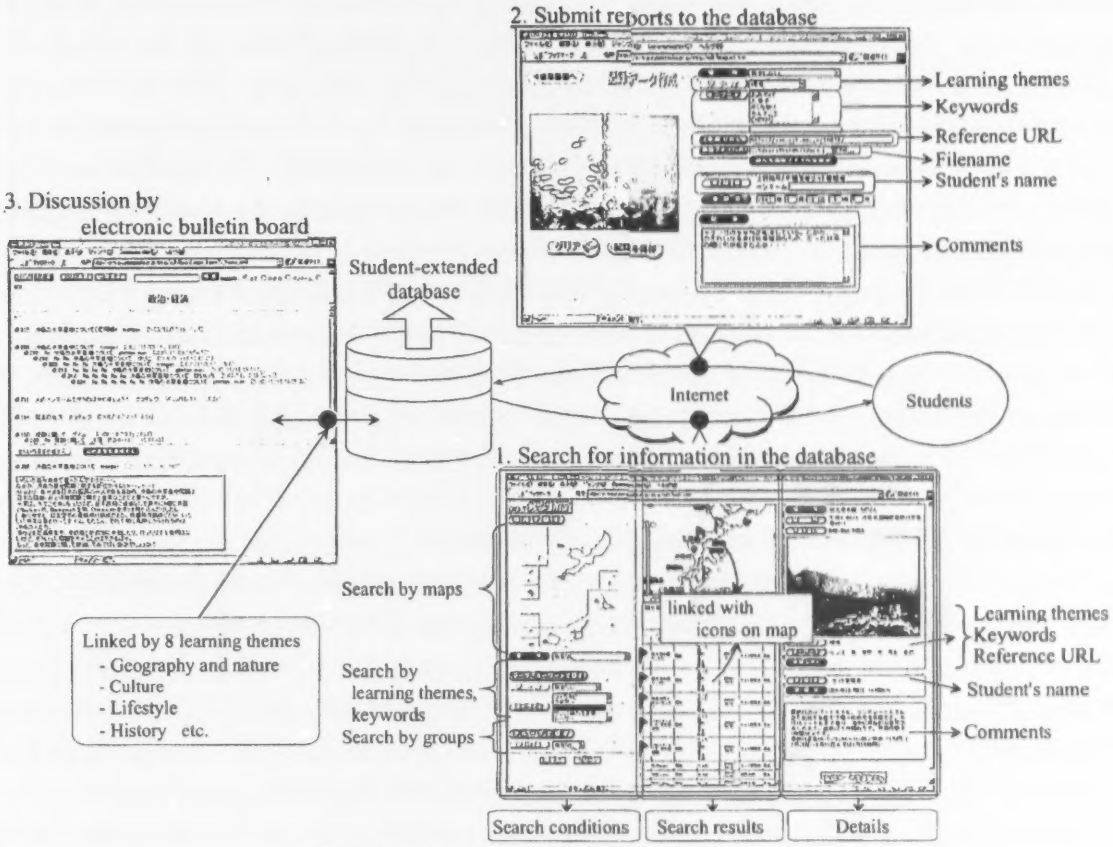

Fig. 2 Overview of the pre-trip learning system.

3.2 Hands-on learning system

The main purposes of the hands-on learning are to experience something at the destination and to record these experiences before they are forgotten. Some systems that support field studies by hand-held devices have already been developed (Rieger et al., 1997, Pascoe et al., 1998). We recognize the importance of hand-held devices, but it will be difficult for students to use them. So, we considered ease-of-use as being the most important factor in the field study. Figure 3 illustrates an overview of the hands-on learning system.

(1) Record the experience

When students go out on a field trip, they each take a bag containing a digital camera, a pocket GPS, a notepad, and a cellular phone. These enable them to accurately record the day's activities and help them arrange their thoughts later. The pocket GPS continuously tracks the path taken by a student and the notepad lets him/her write down thoughts on the spot. Moreover, the GPS and cellular phone are useful items of safety equipment in case of emergency. After they get back to the school or hotel, they can transfer pictures and GPS data to computers and send them to the server. At this stage, the pictures are not openly available to others on the Internet.

(2) Submit reports to the database via the template

When the server receives data from the camera or GPS, it automatically inputs it to the database and presents a template for students to enter their comments. This template is shown in Fig. 3. It is implemented in Java and runs in the browser. The left frame shows all the data of the day's activities. The path recorded by the GPS is plotted on the map and a sequence of thumbnail pictures is displayed below the map. The positions where the pictures were taken are automatically indicated by icons on the map, because they were calculated in advance by matching the time stamps between these two data sources. This helps students remember where and what they experienced. In the right frame, they can input the title, the learning themes, keywords, and comments about each picture. They can also set whether each item of data is public or private on the Internet. The default is private, so only data that they want to show is made public. Thus, parents can follow their children's activities from home via the Internet.

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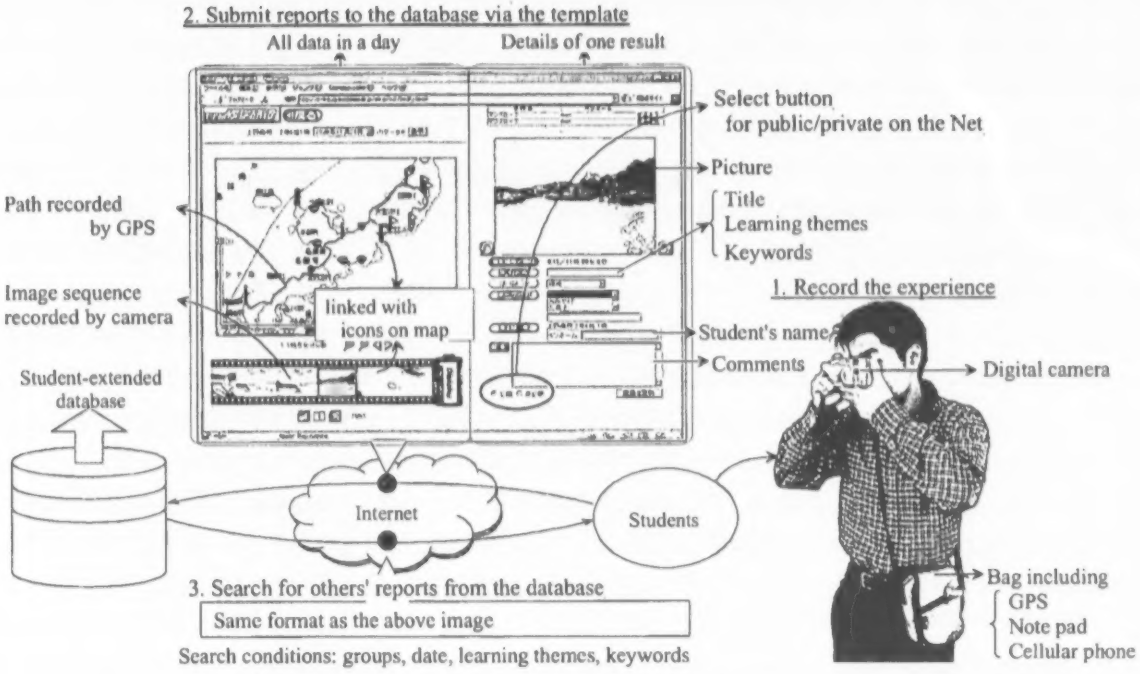
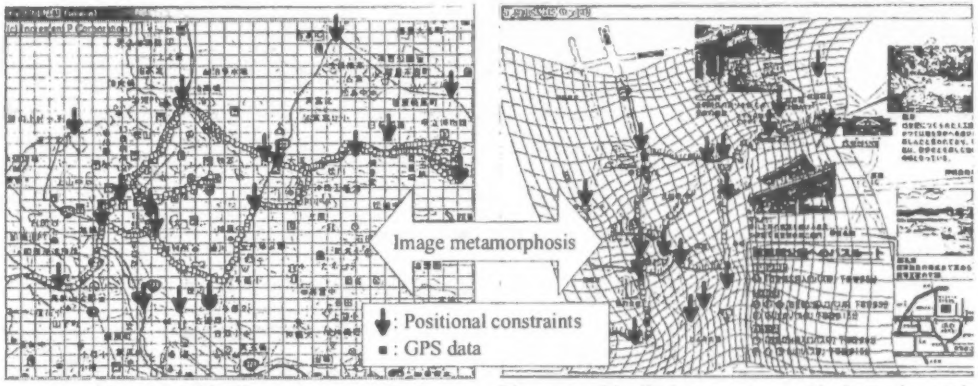


Fig. 3 Overview of the hands-on learning system.



(a) geographically accurate map (b) geographically inaccurate map (schematic map)

Fig. 4 Map deformation between an accurate map and inaccurate map.

This system uses maps obtained via the Internet from a map database that covers the whole country, so it works anywhere in Japan. Alternatively, geographically inaccurate maps such as schematic sightseeing maps can also be used in our system. A sightseeing map is intuitively easier to understand because it is simplified. We have developed a map deformation technique for converting between geographically accurate and inaccurate maps. This technique makes use of the image metamorphosis method (Lee et al., 1996). So, we can calculate the correspondence between two different maps. If you specify some points such as main buildings and crossroads in both maps, GPS data can be automatically plotted in the inaccurate map. Figure 4 shows an example of this map deformation.

(3) Search for others' reports from the database

It is usually difficult to find out later what other groups did. But the eTrip system allows all experiences of all groups to be archived and shared in the database. So, students can easily understand what other groups did or how they felt on the spot by performing a group search or learning theme search of the database.

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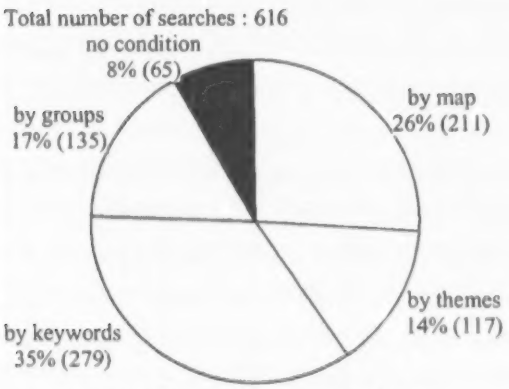

Fig. 5 Searching styles in pre-trip learning.

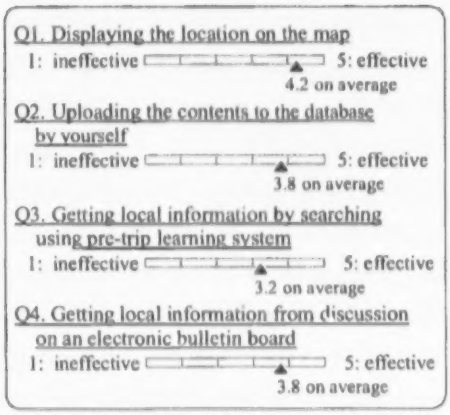
Q1. Displaying the location on the map
1: ineffective
5: effective
4.2 on average
Q2. Uploading the contents to the database by yourself
1: ineffective
5: effective
3.8 on average
Q3. Getting local information by searching using pre-trip learning system
1: ineffective
5: effective
3.2 on average
Q4. Getting local information from discussion on an electronic bulletin board
1: ineffective
5: effective
3.8 on average

Fig. 6 Results of questionnaires on pre-trip learning.

3.3 Post-trip learning

The main purposes of the post-trip learning are to get students to reconsider the learning themes and put their thoughts together through their experiences. We have developed a collaborative editing board over the Internet (Sugiyama, 2001). This enables students to make reports in a free format by groups. It brings out more creativity from students. These reports are presented over the Internet, so anybody can access and look at them.

4. Experiment and Evaluation

4.1 Experiment

We conducted an experiment to see how students actually learn with our system. About 15 groups of senior high school students in Tokyo participated in this experiment. They went to Okinawa on a field trip in 2000. Although Okinawa is only a small island, it has a unique history, distinctive culture, and rich natural environment, so it is a major destination for field trips.

They performed preliminary learning about Okinawa (10/10-11/17), went there (11/21-11/24), and made reports and presented them to the class (11/27-2/7). They also discussed various things about Okinawa, such as the problems related to the U.S. military bases, with the local students using the electronic bulletin board. This experiment was not part of the curriculum, but a voluntary after-school activity.

Since our system uses a client-server environment, a school only needs browsers and Internet access. The access line to the server was 128 kbps. In the hands-on learning, students uploaded their experiences from the hotel in Okinawa. The server, which was located in an NTT facility, used WindowsNT Server as the operating system and Oracle as the database. We are making a version using Linux and PostgreSQL. Access to our web site is restricted by user ID and password in consideration of the student privacy policies.

4.2 Evaluation of the pre-trip learning system

We examined how students dealt with the pre-trip system from the access logs. Figure 5 shows the breakdown of conditions that students used for searching. They made plans by map search (26%), explored local subjects by either the learning theme or keyword search (49%), and found out what their friends were learning (17%). These results mean that all the search functions were useful for students. Figure 6 shows the results of questionnaires for 20 students. They clearly show it was effective for students to get the location of the results on the map.

Students uploaded contents that they found by themselves into the database through the Internet. Unfortunately, the number of such data uploads was not so large (about 30). We suppose this was because the experiment was held as a free activity after school. According to interviews in which we asked the students whether uploading to the database was interesting or not, they gave it a score of 3.8 out of 5 on average. They were very interested in sharing the results of their learning with everyone else.

In the pre-trip learning, students used the electronic bulletin board a lot. They exchanged many comments (about 150) and accessed other people's comments. In particular, it really came alive after local students in Okinawa joined in. One typical comment from the students was "It is really useful to get hot news and opinions from local students directly."

4.3 Evaluations of the hands-on learning system

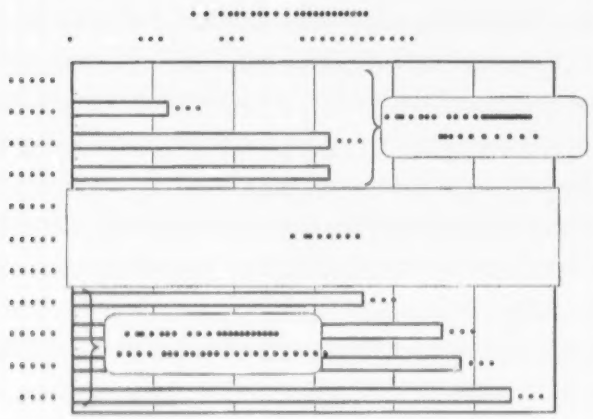

Fig. 7 Chronology of data uploads in hands-on learning.

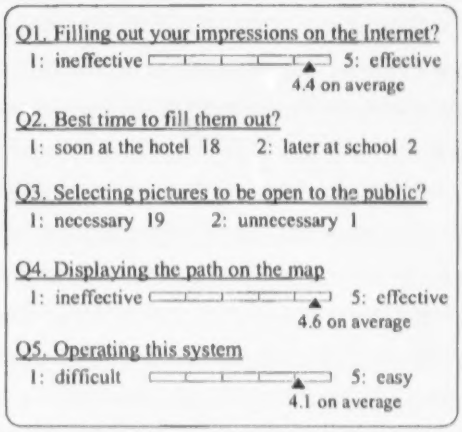
Q1. Filling out your impressions on the Internet?
1: ineffective
5: effective
4.4 on average
Q2. Best time to fill them out?
1: soon at the hotel 18
2: later at school 2
Q3. Selecting pictures to be open to the public?
1: necessary 19
2: unnecessary 1
Q4. Displaying the path on the map
1: ineffective
5: effective
4.6 on average
Q5. Operating this system
1: difficult
5: easy
4.1 on average

Fig. 8 Results of questionnaires in hands-on learning.

Students had an enjoyable and serious time recording their experiences with digital cameras in the daytime and adding comments to the pictures in the evening. Almost all of them made comments like "It is very effective to write comments before they slip from memory" and "it is exciting to make our experiences openly available on the Internet." Even though the work of writing comments was done in their free time in the evening, many of them were enthusiastic about spending two hours or more on it. That was a surprise to us.

Figure 7 shows the chronology of the data uploads in the hands-on learning. The total number of the data uploads was more than 500 and the students continued updating their experiences back at school and home after returning to Tokyo. That was also a big surprise to us.

Figure 8 shows the results of the questionnaires for 20 students. The results demonstrate that this system is useful, exciting, and easy for students to use as all the scores were more than 4 points. In particular, students said that choosing to make the pictures openly available on the Internet was absolutely necessary.

5. Conclusions and Future Work

We outlined our eTrip system, which supports the whole learning flow for a field trip. The system is designed to give students an environment for collaborating with other students or local schools. It is characterized by a "student-extended database" and "electronic bulletin board." The results of our experiment show that it was effective and exciting for students to put their experiences together and make them public on the Internet with our eTrip system. And the electronic bulletin board was also used a lot especially before the trip. It enabled students to get useful information from local students.

In the future, we will extend this system to improve the integration of the pre-trip, hands-on, and post-trip learning. For example, we think that students should be able to retrieve the contents that they examined in advance on the spot and to put their thoughts together easily via a template comparing the contents of the pre-trip and hands-on learning. Moreover, we want to apply this system to other subjects such as environment or geography education to archive the learning on the map by students.

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Web Based Language Training with Tell Me More Online

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Abstract: Over the past ten years, the advent of information technology and multimedia has revolutionized language learning. Ever since it was founded, Auralog has been investing heavily in the technological and educational adventure. As a result, the company has become the reference for language learning with the integration of speech recognition technology into its software. Speech recognition offers the opportunity to practice oral and listening skills. Today, the growth of the Internet is opening up new territory: a new generation of language learning has been born, offering the opportunity to learn a foreign language online. Auralog, with Tell me More Online, offers a complete language course online, containing all the advanced technology previously developed by the company. The course includes speech recognition, interactive dialogues, grammar, vocabulary, written exercises, videos etc. Thanks to the Internet, learners also have the possibility to benefit from the assistance of a personal tutor.

Background

The evolution of language learning through the ages can be classified into four major stages:

1. *The Teacher's Voice and The Written Word*
   Originally, students relied on written aids (books, dictionaries, encyclopedias...) and only had one way of improving their pronunciation: reproduce, as closely as possible, the teacher's voice, which was their only reference.

2. *Voice Recording*
   It was with recordings of speech that new technology started to have an influence on language teaching. As well as traditional written aids, students now had access to audio (cassettes, audio CD's, radio etc.) and video aids (films in his or her original language, television).

   To perfect pronunciation, a student could make a tape recording of his or her own voice and play it back. Early tape recordings gave way to digital technology, but despite this improvement in sound quality, the technique offered very limited possibilities. It relied on the listening abilities of the student, i.e. on the student's sensory perception, which is highly variable from one person to another.

3. *Speech Recognition*[1]
   It was not the appearance of the first CD-ROMs that presented a real breakthrough in language learning. Indeed the first language learning methods produced on this format constituted nothing more than a simple transfer of the contents of existing aids from their traditional formats onto this new one.

[1] The term 'speech recognition' encompasses the entire range of technology that allows a machine to recognize speech. Modern speech recognition technology is based on an analysis of the phonemes that make up a spoken sentence. Auralog was the first company in the world to incorporate this technology into the teaching of foreign languages.

In fact, it was only in the beginning of the 1990s, with Auralog's launch of the first language learning method based on speech recognition technology, that language learning reached the third stage in its development by freeing the student from the constraints of sensory perception and offering in its place a scientific evaluation of pronunciation.

Auralog allows the student to enter into a fluent, interactive dialogue with the computer, without the need to use either the keyboard or the mouse, and to obtain an automatic evaluation of his/her pronunciation. Thus the computer became a precise, ever-available and indefatigable coach.

4. *Online*

Thanks to the Internet, language learning recently reached the fourth stage in its development. All the technology earlier developed by Auralog has now been transferred to the Internet. This has led to a more flexible learning where the student can work at any time and in any place. This new way of learning languages also offers the student the possibility to have access to a personal tutor. The student is thus accompanied all through the learning process and the course can be particularly adapted to every student's needs and objectives.

The students can not only communicate with their tutor, but also with other students all over the world who are learning a foreign language or are simply curious about other countries and cultures. The Internet also offers the possibility to give students access to a resource center with links to other sites to help student's progress in their learning and widen their cultural knowledge.

The fact that the pedagogical content is online presents another advantage compared to CD-ROMs; the content can be updated more often. Minor changes in the software can thus be made regularly and in very short time, without forcing the students to buy a new version.

The Technology

Tell me More Online incorporates the very latest technological innovations: automatic detection of pronunciation errors with S.E.T.S. technology (Spoken Error Tracking System), 3D animations to visualize the articulation of phonetic sounds, and a web site where the millions of users of Tell me More around the world can meet and chat (voice or text).

1. *Advanced Scoring System*

With advanced speech recognition, the students can enter into a genuine dialogue with the computer. The user's responses guide the conversation. The learners can adapt the speech recognition to their own level, making the computer's evaluation of pronunciation quality more tolerant or more demanding. When the user pronounces a word or sentence, he/she receives a score which can be used to evaluate the quality of the accent, the pronunciation and the intonation.

2. *S.E.T.S*

Up until this point, speech recognition had been made to function for continuous speech, on complete sentences and independently of the speaker. The one remaining problem facing development teams was how, within a complete sentence, to precisely identify the word where a pronunciation error had occurred.

After several years of research, Auralog's software engineers perfected a technological development enabling the computer to automatically detect such an error in a spoken sentence.

This exclusive technology has been called S.E.T.S. (Spoken Error Tracking System). By locating the weaknesses in the learner's pronunciation, S.E.T.S. represents a crucial step forward in computer-assisted foreign language learning.

3. *Waveforms and Pitch Curves*

The software also allows the student to visualize accurately not only pronunciation but also intonation. Two types of display mode (waveform and pitch curve) are provided. The student can display them at the same time, or individually.

The waveform indicates the amplitude of the voice as a function of time (the notion of energy). It represents the sound intensity of the voice and gives a view of the structure of the pronunciation.

The pitch curve represents frequency variations in the voice. In tandem with the waveform, this curve enables students to make precise comparisons of their own intonation with that of the model (high-pitched/deep). This unique display mode is an innovation developed by Auralog.

Auralog is the only software publisher to offer applications evaluating the pronunciation and intonation both of complete sentences and of words, and which allows them to be visualized.

4. *Phonetic Animations*
Computer animations of individual phonemes allow the learner to observe articulations in close detail, and to reproduce them more accurately.

This exceptional technology helps the learner understand the articulations involved in producing certain sounds, which in turn facilitates recall, and leads to better reproduction.

Pedagogical Content

Tell me More Online has a rich and varied content for each language available (French, German, Spanish, Italian, Dutch, and American and British English):

- 1600 hours of learning for each language
- 144 interactive dialogues to perfect pronunciation
- 5000 exercises that develop different language skills
- a glossary and a dictionary to enrich the student's vocabulary
- 400 grammar rules
- 700 conjugated verbs
- videos in MPEG format for work on oral expressions

Learning Support

The latest generation of software takes this to a new level by offering a comprehensive product in terms of content and technology. It combines the advantages of both home study and made-to-measure teaching with real tutors thanks to the flexibility of Internet use.

1. *The Help of a Tutor via Internet*[2]
Even though multimedia has helped language learning and introduced interactivity, in the long-term it is not capable of satisfying those students who are looking for more personalized supervision and who are discouraged by home study.

The new generation of language learning courses with a personal tutor allows the introduction of a human element to motivate the students and supervise their aims. Thanks to the balance of pedagogical resources, the pupil and tutor will be able to build a program together with stimulating, personalized, and varied activities.

[2] See Appendix for a description of the different tutoring services

The Club environment of the web site, club.auralog.com, adds another interactive dimension. This site invites users of Tell me More to discover an abundance of complementary resources and a social area where they can actively use their learned language, play games, hold conversations, pick up cultural or practical information and improve their knowledge. For example a German learning Spanish can enter into a constructive conversation with a Spanish learning German.

2. *The Advantages of Learning Support Combined with Home Study*

The student will now be able to benefit from integrated pedagogical support via Internet. It is the closest thing to having a real teacher without the traditional disadvantages. Indeed, traditional lessons with a real teacher can be very efficient but quickly become extremely expensive. The fees go down as the number of participants increases, but unfortunately the level of efficiency is inversely proportional to this number.

Moreover, lessons present a geographic and time constraint: the student must travel somewhere that is not always convenient, and at a fixed time and frequency which may be a problem for anyone who works. The new technology (networks, electronic mail, Internet etc.) therefore allows the student to maximize the benefits of home study, but with permanent access to a personal tutor.

The advantages of this new concept thus lie in the interaction between your own work done in the activities offered by the Tell me More course and the human aspect of teaching offered by a personal tutor via Internet. The following are four examples of the dynamic relation created by a combination of support in the software and via Internet to create a perfect balance between home study and personalized learning (learning support).

Example 1. With Tell me More, the student has the opportunity to carry out a real exercise in written expression. They can be invited to describe, in the language being learned, a scene that appears on the screen. The software carries out an assessment of this work by looking for and correcting obvious spelling and grammar mistakes. The tutor will then receive the work carried out by the students in order to be able to give them more precise information about their mistakes and advice to improve their written expression.

Example 2. The student is working on some of the activities and experiences difficulties; they report to the tutor. The tutor will then analyze the nature of the problem and send the students a learning path that is better adapted to their aims and needs thanks to the possibility of automatically sending complex files of student tracking by e-mail.

Example 3. The pupil may not understand the syntax or construction of a sentence in the dialogue contained in Tell me More and thus asks his/her tutor by e-mail for a precise explanation about the grammar point involved.

Example 4. The student wants to get in touch with other students wishing, like him or her, to practice speaking naturally in the language. The tutor will indicate to the student a forum on the web site: club.auralog.com which has been designed for the needs of students registered in the Distance Learning Tutor Program.

It is therefore a new generation of language learning incorporating the knowledge and teaching skills of a teacher with the resources of Internet. This learning solution is the result of more than 10 years of research and development of speech recognition and computer-assisted learning. Today with the incorporation of learning support and the transfer of the content to the Internet, Tell me More Online has become an individualized solution for language learning; a real personalized language course on the computer.

Appendix – Tutoring Services

The different tutoring services include the following :

- *Initial Assessment* : The tutor evaluates the student's level on the basis of a linguistic test, analysis the work done by the student in the different activities in The Tell Me More Collection, and sends a personal assessment by e-mail.

- *Individualized Learning Paths* : The students can receive a learning path, by e-mail, with activities adapted to their level and aims, in the form of a program file. For example, should the student want to concentrate in particular on speaking, the tutor will suggest an appropriate study plan. If, during the course of study, the tutor decides that the learning path should be modified or refined, a new learning path will be suggested.

- *Linguistic Questions* : With the tutoring services, the students have the opportunity, on a permanent basis, to enter into a discussion via e-mail with their tutor. They will thus be able to clarify certain grammar points, obtain useful hints for optimal use of the software, ask the meaning or translation of a term or sentence, or have a conversation about any subject.

- *Correction of Written Exercises* : The tutor will correct the written expression exercises in more depth and help the student to acquire more natural expressions in the language being learned.

- *Regular Monitoring* : Just like a normal teacher, the tutor will monitor the student, check his or her progress, encourage them and regularly examine his or her results.

- *Access to the Auralog Club on the Internet* : The students will become regulars in the user-friendly chat room, reserved especially for them at this web site, which is particularly equipped for their needs.

And, as an option :

- *Personal Appointment* : The student can agree upon an appointment time to have a real-time conversation with the tutor to talk about subjects that interest them.

A Global Overview of New Business Paradigm: the Digital Divide

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Abstract: We are living in an interesting *era* of the explosion of knowledge. This is due to the revolutionary impact of Information Technology. The wonder of the last century is the discovery of the Internet which continues to drive an economic boom in the United States and other developed world. The new business paradigm is due to the emergence of electronic markets in the cyberspace. The current change of paradigms is altering the rules of economic activity radically and helping increasing globalization which is also accelerating more *digital divide*. The purpose of this report is to give a bird's eye view of this interesting paradigm shift and also to discuss the status of India in the context of the Digital Divide.

Introduction

Let us start with a quote by Bill Gates, Microsoft Co-Founder & Chairman: 'Going digital will put you on the leading edge of a shockwave of change that will shatter the old way of doing business. A digital nervous system will let you do business at the speed of thought, the key to success in the 21st century'. This is a paradigm shift which is occurring in the business environment and marketplace. The phenomenon promise and rise of the Internet and subsequent rapid development of electronic commerce have constituted this new business paradigm. This has also given rise to new economy called Digital Economy which is the root of globalisation. The rapid globalisation is harming many developing countries. India being an emerging superpower in IT is experiencing bottlenecks to reap the benefits fully out of this new business paradigm.

Digital Economy – what is it?

The growth in the use of the Internet as a result of huge investment in information and communication technologies (ICTs) has generated the digital economy. Spending on ICTs worldwide topped $US 2.1 trillion in 1999, and expected to exceed $US 3 trillion in 2003. In knowledge and digital-based economies, more workers create or work with information than create or work with their hands. In the digital age, Information is the source of wealth and power. Technologies are a vital driving force to economic growth.

The global status of the new economy is correctly reflected in a study by the Organization for Economic Co-operation and development (OECD, 1999): "Visions of a global knowledge-based economy and universal electronic commerce, characterized by the 'death of distance' must be tempered by the reality that half the world's population have never made a telephone call, much less accessed the Internet." There is no easy answer how to overcome this digital divide. However, Internet-based businesses can bring about faster economic development to developing countries. It is worth mentioning quote of Abraham Lincoln: 'Always bear in mind that your own resolution to succeed is more important than any other thing'. Digital economy provides a unique opportunity to extend a local organization to a global presence with limited resources.

A Paradigm Shift

Transformations of business activities are undergoing everywhere. The increasing globalisation of markets and, in conjunction with this, the worldwide presence of individual companies, called for a re-think in terms of product presentation and market communication. In this time of transition new paradigm is replacing old paradigm of industrial economy. The paradigms in the digital era means – doing business with anyone, at any time, anywhere. The basic paradigm of the cyber world also means e-commerce with electronic networking of customers, suppliers and partners. In the industrial era, business was possible with individuals at defined times and in certain location only, but this rule no longer applies in new business paradigm which operates globally without distance and has no closing times (Rohner, 1998). This new business paradigm is helping developed world, but the majority of the developing world are lagging behind. Some developing countries, for example India and China are making inroads to gain advantage out of this paradigm shift.

Digital Divide – in a Nutshell

We define 'Digital Divide' as the gap among countries with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities. The *digital divide* may also reflect differences of those factors within countries. The most basic and most important indicator of the digital divide is the number of telecommunication access lines per 100 inhabitants at an international level. There were over 851 million access lines in 1998 with some 64.5% in OECD countries. In countries

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with the lowest GDP per capita, there were only 1.6 lines per 100 people during that period. The share of OECD countries has steadily fallen over the 1990s, in part because access lines in China have risen from 6.6 million in 19990 to 87.4 million in 1998. There were just over 94 million Internet hosts in the world in October 2000, with 95.6% in the OECD area and 4.4% outside the OECD area (OECD, 2001). E-Commerce is one of the most significant information innovations that are the key to productivity and economic growth. The size of the e-commerce is huge to be $US1.6 trillion by 2003- according to a recent study international Data Corporation (IDC) and the USA dominated the 62 per cent of this electronic market by the end of 1999. The picture of e-commerce is gloomy in developing countries.

India in Digital Age

India's dramatic software sector has been growing at 50 per cent annually since 1991 and has captured a fifth of the global market share in customised software (Kumar, 2001). Indian software exports for 2000-01 were more than $US6.2 billion. But the penetration of the Internet is insignificant in India due to the lack of telecommunication facilities. It has nearly 5 million telephone connections. The number of Internet connections in the country was close to one million as on March 31, 2000. The National Association of Software Companies (NASSCOM) has predicted the number of Internet connections, as per its survey, will grow to 8 million by the year 2002. Details are given in Table 1 below:

Year	1997	1998	1999	2000	2001	2002
Connections in millions	0.2	0.45	0.8	1.5	3.5	8

Table 1: Internet Connections

India has less than 10 GBPS international bandwidth. According to the survey, India compares badly with China or UK and Japan in terms of bandwidth availability. China has an international bandwidth of 55 GBPS; UK has 120 GBPS while Japan has 160 GBPS. If the bandwidth requirements are not met in time, India can lose its ability to compete in at least 30 per cent of its target export markets. The NASSCOM has recommended that under the "Operation Bandwidth", the policy of the department of telecom should change and allow *international leased lines* to be connected to *public switch telephone network* (PSTN) in the country. As well as the problems posed by the US slowdown, the Indian IT sector also faces growing competition from China which is fast emerging as a regional IT giant. One positive note is that India is in forefront to device a legal framework for doing business in the connected world among all developing countries. India passed the Information Technology Bill in 2000. The Bill aims at providing legal recognition to transactions carried out through electronic data interchange and other means of electronic communication, commonly known as e-commerce. There are no direct taxes for e-commerce in India and central government has taken a lot of initiatives to create positive atmosphere to introduce this new business.

Conclusions

The Internet provides a fantastic opportunity to extend a local organisation to a global presence with minimal capital, no physical global presence, and limited inventory assets (Nemzow, 1997). The increasing importance of undertaking business using Internet based technologies has been identified many authors (Amor, 2000, Kalakota, and Whinston, 1997, Karmakar, 2000a & 2000b and Karmakar, 2001) The business benefit in the new paradigm is not automatic, it needs significant financial commitments and only developed countries can afford this. Many developing countries have little potential to compete in the digital age. So there will be a further gap between 'haves' and 'have-nots'. The divide between the developed and developing countries is growing and constitutes a global concern. India has great history of mathematical talent, it produces also tens of thousands of IT and other high-tech graduates each year with good knowledge of English. India needs to improve its telecommunication services to exploit Internet technologies for enjoying economic benefits in this evolving new business paradigm.

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Heuristic Evaluation of Web-Sites: The Evaluators' Expertise and the Heuristic List

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Abstract: Research for the evaluation of web-sites has already begun, however it is proceeding at a very slow rate. The main reasons for this are, in our opinion, the attempt to adapt existing methodolo gies to the particularities of the web, the individual structure of web-sites and the issue of finding the appropriate evaluators. This study copes exactly with these points and suggests a heuristic approach for the evaluation of web sites.
In our study we tried primarily to train the evaluators in the particularities of the heuristic evaluation, in its classic form as well as in its web-adapted form. By doing this we try to answer the core question if we can augment the evaluators' expertise with a kind of training prior to the conduction of the evaluation itself. Next we used web-adapted heuristics, found in relative literature and tried to clarify them to the evaluators as well. Finally the evaluators were involved in a real evaluation of five web sites and they wrote down their comments on appropriately prepared questionnaires.
The results from this study confirm firstly two known conclusions, that the method is applicable to the Web and that the prior evaluators' expertise is of great importance. Yet, in addition to these, we concluded that it is possible to augment, under conditions, this expertise in a short way so they have an increased performance during the evaluation as well. Our main conclusion is, however, that the used heuristic list performed inadequately, but we noted the trend of the evaluators following a somewhat similar mode of thinking, thus providing us with the way to adapt these heuristics in a more holistic approach to the web.

Keywords

Evaluation, heuristic evaluation, human computer interface, web, web evaluation.

Introduction

Maybe the most frequently encountered evaluation method, of any entity, is the provision of a list of criteria (heuristics) relative to this entity followed by questioning in order to express peoples' opinions. These people can be users or experts on the particular domain. So we distinguish between user-based evaluations, known as "empirical evaluations" and expert-based evaluations. What can we evaluate in this way? Makrakis (1999) says everything has to do with:

- The design
- The organization
- The function
- The result of the entity under consideration

However, a number of problems arise from this approach.

- It provides all the disadvantages of the expert-based evaluations (Karat et al., 1992; Nielsen, 1993a; Karoulis et al., 2000b).
- The axes and heuristic list may become very long (Lewis & Rieman, 1994; Nielsen, 1993a). For example, the full interface usability criteria list suggested by Smith & Mosier (1986) includes 944 criteria.
- The evaluators' expertise plays a major role. (Lewis & Rieman, 1994; Nielsen, 1993b). We discuss this issue in detail later.

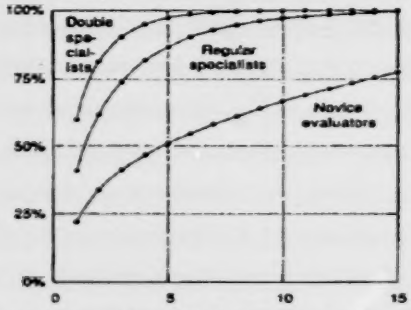
The Heuristic Evaluation

To handle these problems Jacob Nielsen and Rolf Molich started their research in 1988 and in 1990 they presented the "heuristic evaluation" (Nielsen & Molich, 1990). The basic point was the reduction of the set heuristics to just a few, at the same time being broadly applicable and generally agreed; simultaneously augmenting the evaluators' expertise, and consequently their reliability. The method refers mainly to human-computer interface evaluation, yet a number of studies (Nielsen & Norman, 2000; Instone, 1997; Levi & Conrad, 1996) have proven its easy adaptability to the evaluation of web sites as well. This study belongs to this category.

The appropriate number of evaluators and their expertise are an issue of great importance. Researches up to now (Nielsen & Molich, 1990; Nielsen, 1992; Nielsen, 1993b) have shown that:

1. *Simple or novice evaluators.* They do not perform very well. We need 15 evaluators to find out 75% of the heuristically identifiable problems. The research has shown that 5 of these simple evaluators can pinpoint only 50% of the total problems.
2. *HCI experts (regular specialists).* They perform significantly better: 3 to 5 of such evaluators can point out 75% of the heuristicaly identifiable problems and among them all major problems of the interface.
3. *Double experts (specialists).* These are HCI experts with additional expertise on the subject matter. The reasearch has shown that 2-3 of them can point out the same percentage as the HCI experts.

The following diagram by Nielsen (1992) summarizes these statements.



As we can see in the diagram, to point out 75% of the heuristically identifiable problems we need 15 simple evaluators, while 3 expert evaluators bring the same result.

Adaptation to the Web

Evaluation in the web differs from the traditional evaluation methodologies in many ways, due to the particularities of the web: every web site is an information space with non-linear structure, so two parameters, the download time and the ease of navigation, are of great importance. In addition to this, the evaluation procedure can be conducted by every evaluator on his/her own, redefining the notion of the "evaluation session" and introducing the notion of the "asynchronous evaluation", since the evaluators can perform their work from different places and at different time. Finally, in the web every evaluator is at the same time a user. Norman (2000) presents, for example, a cognitive walkthrough (Wharton et al., 1992; Lewis et al., 1990; Karoulis et al, 2000) performed in the web, playing the role of the simple user and thus proving the efficiency of this combination. This particular occurance on its own adds to the expert based evaluations in the web the hue of the empirical evaluation as well, augmenting its reliability, since the combination of user-based and expert-based approaches seems to provide the best results (Karat et al., 1992; Karoulis & Pombortsis, 2000; Karoulis et al., 2000b). The adaptation of the heuristic evaluation in the web has been already studied by researchers (eg. Instone, 1997; Levi & Conrad, 1996) and the results are in agreement that, in general, it is effective. Other researchers however consider that this issue has not yet been researched enough (Trochim, 1996; Lowe, 1999), and we adopt that opinion too.

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Research Questions

Given the youth of the web technology and the speed at which the web is growing, it seems indispensable that researchers conduct steady studies on its parameters, which are more often than not very variable. Bearing this in mind, in this study we are concerned with the specialized adaptation issues of the heuristic evaluation to the web and our main questions are as follows:

1. Can we, mainly, apply the heuristic methodology in the web?
2. Can the power users' expertise be augmented through some kind of "training", so that they can perform as well as expert evaluators?
3. Is the same list of heuristics valid for the web as for the evaluation of traditional interfaces?

The first question, as already mentioned, is a point of disagreement, consequently one more piece of evidence will strengthen either one of theses views.

Let us now consider the second question. It is known that it is possible for computer scientists to easily learn the evaluation methodologies and apply them sucessfully (Nielsen, 1992a; Wright and Monk, 1991). But computer scientists (the "experts") are not yet available in great numbers, so one can't argue that he/she will find someone to conduct the evaluation. So the following question arises; can some power users be trained in heuristic evaluation and be allowed to play the role of the expert? So our question refers in particular to how far a short training period can help the evaluators cross this zone in a feasible time towards the application of the heuristic evaluation methodology.

The heuristics are already broadly known and agreed, in the way Nielsen (1994b) suggests them. These heuristics have been adapted and ommented by Instone (2000) for their application in web-based heuristic evaluations, as follows:

1. *Visibility of system status*. The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
2. *Match between system and the real world*. The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms.
3. *User control and freedom*. Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
4. *Consistency and standards*. Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
5. *Error prevention*. Even better than good error messages is a careful design which prevents a problem from occurring in the first place.
6. *Recognition rather than recall*. Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another.
7. *Flexibility and efficiency of use* Accelerators - unseen by the novice user - may often speed up the interaction.
8. *Aesthetic and minimalist design*. Dialogues should not contain information which is irrelevant or rarely needed.
9. *Help users recognize, diagnose, and recover from errors*. Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
10. *Help and documentation* Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation.

So the third question set in this study is if these heuristics are appropriate for the web and really efficient in the way Instone (2000) declares them to be.

Adaptation, Organization and Conduction of the Evaluation

The evaluators conducted the evaluation in their own environment and using their own mode of internet connection. The first immediate consequence is the need to train the evaluators in a written manner in all necessary detail to fully clarify the procedure, but not to an excessive degree, so that phenomena of discouragement occure. Therefore we prepared a booklet, which we titled "Notes to the Evaluators", consisting of 7 pages, and describing the methodology of the heuristic evaluation by Nielsen (1992; 1994a and 1994b), as well as its adaptation in the web, and finally the description of the procedure the evaluators had to follow to complete their work. In addition to this, they have been equiped with another booklet, consisting of 5 pages,

containing the web-adapted heuristics of Instone (2000) and their comments. The training material included an "Evaluator's Notebook" as well, where the participants could note down their assessments and opinions.

Results and Conclusions

Before starting the presentation of the results of this study, we would like to emphasize that the object of this study was not to evaluate the web sites under consideration, but to answer our research questions on the efficiency of the method and the chosen evaluators on the web. With this view in mind, we omit the results of the evaluations concerning the usability of each particular site. A direct consequence is that the aggregation of the evaluators' opinions is no longer necessary, as suggested by Nielsen (1994b) in order to obtain the evaluation results about the sites.

To proceed, we needed to group and categorize all the opinions of the evaluators in a separate supplementary document. In this document we provide the evaluators' opinions, as well as our assessments about the different heuristically identifiable problems. This approach can be found in the relevant literature (Nielsen, 1992, Lewis & Rieman, 1994) and relies on the observation that the conductors, in this case us, who are obviously HCI experts, can point out the majority of the usability problems during the preparation phase of the evaluation, that the evaluators will discover later on. This fact is a consequence of the discovery that a few double experts can pinpoint most of the problems. However, in our study this issue has proved to be insignificant, because the problems that were not discovered by us, but were found by the evaluators during the session, could be rated on their severity afterwards and matched with the corresponding heuristics. We noted our opinions in columns, next to those of the evaluators'.

The answers to our research questions can be given briefly as follows:

1. *Can we, mainly, apply the heuristic methodology in the web?*
   The answer to this question is affirmative, which is in agreement with most of the studies up to now. However, in order to apply the method effectively, the results of the following points must be taken into consideration as well.
2. *Can the power users' expertise be augmented through some kind of "training", so that they can perform as well as expert evaluators?*
   Yes and no. This also confirms the results from previous studies, that report the experts performing very differently from the simple users. However, this question is more complicated and will be discussed in detail later.
3. *Is the same list of heuristics valid for the web as for the evaluation of traditional interfaces?*
   The answer, according to our study, is negative. The heuristics we used seemed not to facilitate the evaluators in their work. They stated that they "interpreted" them to be applicable in different instances, and they provided us with some hints as well.

In more detail, heuristic evaluation performs well even in the web, yet the main issues of the evaluators' expertise and the validation of the web-heuristics remain.

The starting point for this study was the question if we could involve only power users, eg computer science students, instead of the difficultly in finding HCI experts. The separating line between these groups is not clear and our study can finally only approve the results of former studies (Nielsen & Molich, 1990; Nielsen, 1992) that suggest careful selection of the evaluators.

According to the mode of the training, four of the "successful" evaluators considered the booklet as "very lucid and enlightening", three considered a face-to-face seminar as a better solution without an optional booklet, while the rest had no opinion about this issue. There is additional evidence on this issue by Nielsen & Mack (1994), that heuristic evaluation can be taught in a half-day seminar, so this proposed approach seems to be a better one.

Regarding the third question on the appropriateness of the heuristics, it was clear that the used heuristics did not even facilitate the "successful" evaluators. On the contrary, some suggestions were made to us, as well as our collecting the evaluators' comments which resulted in a more lucid web-adapted heuristic list that seems to be more familiar and appears to facilitate the procedure.

Collecting the evaluators' answers we distinguished 28 categories of discovered problems. Most of these categories adhere to one or many of the above mentioned heuristics, as already commented. However, in this list there are categories that refer to the content of the web-site, its design as regards functionality or for not supporting the task the user wants to perform. These issues are obviously the concern of the user-centered design, which in the evaluators' opinion has not been applied, but is unavoidable, especially if one is designing for the web (Lewis & Rieman, 1994). Let us mention at this stage that in the assembling of this list we took into

consideration the results of this study and the evaluators' comments. However, the heuristics of Nielsen (2000b) and Instone (2000), as well as the prososals of Lowe (1999), which have been mentioned earlier, still remain as an underlying structure. Finally we also took into consideration the work of Togniazzini (2000), who proposes criteria (heuristics), not for the evaluation process itself, but for the design of web-sites, which are very close to the results of this study. The structure of the list we present is slightly different than usual: it consists of axes, which contain criteria (heuristics) as follows:

Axis 1: Visible system status and in correspondence to what the user expects.

1.1.: Navigation. Is it obvious where am I and where can I go next?
1.2.: Are all the icons and/or navigation possibilities visible and is it clear where they lead?
1.3.: Are all semantics clear and all functional graphics clear as to what they do?
1.4.: Is consistent language used, are international standards respected?

Axis 2: Flexibility of use and structural integrity

2.1.: Are there the necessary "accelerators" available? Can all pages be bookmarked?
2.2.: Has the site been debugged? Are there any empty areas or dangling and dead links?
2.3.: Does the site follow the conventions of the web?
2.4.: Does the site support its exploration? Is there a site map, search function etc.?
2.5.: Can the user easily remember the stucture, the functional and navigational mode of the site?

Axis 3: Efficiency of use.

3.1.: Are the technologies wisely used? Are these technologies acceptable for all user configurations?
3.2.: Are the response times of the site in line with what the user expects?
3.3.: Does the site adhere to the independent philosophy of the web?
3.4.: Does the site provide direct access to the most common tasks one can perform in it?

Axis 4: User control, user-centered design and interaction

4.1.: Can the user completely control all the interactive elements?
4.2.: Are there the corresponding interaction elements to the tasks that the user aims to perform?
4.3.: Is the feedback of these interaction elements of the kind the user expects?
4.4.: Does the site support all the tasks the user aims to perform?
4.5.: Can the user perform the tasks of his/her interest with minimal cognitive load?

Axis 5: Content and presentation

5.1.: Is there the right amount of information in the site (not insufficient or excessive)?
5.2.: Is there the right quality of information in the site (valid, clear, apropos)?
5.3.: Does the site give the impression of having been constructed and then left on its own?
5.4.: Is the information presented in a web-centric way, or is it just an adaptation of printed material?
5.5.: Is the information presented graphically acceptable? Easy to read?

Axis 6: Subjective satisfaction, communication and help

6.1.: Does the user feel he/she is isolated or left on his/her own?
6.2.: Is the site, in general, pleasant to use? Encourages exploration?
6.3.: Is there help, search function, external help, glossary?

The approach of building the list in axes containing criteria (heuristics) supports its application in two forms, as it may be obvious. One is the compact form – only the axes – if there is a shortage of resources (time, money etc.) or if we have very experienced evaluators available. The other one is the analytic form – all the criteria – for a more detailed evaluation of the site.

Summarizing the above, we argue that firstly special care must be taken in carefully selecting the evaluators, so that they have the nessesary expertise in computer science. Secondly, one has to follow a training approach with a seminar in addition to the booklet and finally use our proposed list of criteria that seems more familiar to the particular evaluator category. As a final conclusion to all the above, we believe that the method will finally have enough potential to provide an alternative solution in a situation where there are not HCI experts available to perform the evaluation.

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Goal-Aware Exploration Makes Learning in Hyperspace Constructive

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Abstract: The main problem addressed in this paper is how to help learners construct knowledge in exploring hyperspace provided by existing hypermedia/hypertext based resources on the Web. The knowledge construction involving reflection needs an awareness of exploration goals, which mean the reasons why learners have explored web pages. We have accordingly designed a learning tool called interactive history, which enables learners to annotate their exploration history with exploration goals arising from visiting web pages. It also generates a knowledge map from the annotated exploration history, which map spatially represents the semantic relationships among the web pages explored. The results of a case study indicate that the interactive history promotes goal-aware exploration and reflection particularly in a more complicated hyperspace.

Introduction

Existing hypermedia/hypertext based resources for learning/education on the Web generally provide learners with hyperspace where they can explore the web pages by following the links among the pages to learn the domain concepts/knowledge in a self-directed way. The exploration often involves constructing knowledge from the contents that have been explored, which would enhance learning (Kashihara, Ujii, and Toyoda, 1999; Thuering, Hannemann, and Haake, 1995). However, learners often fail in knowledge construction since what and why they have explored so far become hazy as the exploration progresses. The constructive learning accordingly requires reflection on the exploration process (Tauscher and Greenberg, 1997; Thuering, Hannemann, and Haake, 1995).

Having a careful consideration of exploration process in hyperspace, we have designed a learning tool called interactive history for constructive learning with existing web-based resources, and suggested that the constructive learning involving reflection particularly needs an awareness of exploration goals, which mean the reasons why learners have explored, since how to shape a knowledge structure in hyperspace is greatly dependent on the exploration goals (Kashihara, Hasegawa, and Toyoda, 2000). In order to enable a goal-aware exploration, the interactive history accordingly allows learners to annotate their exploration history with exploration goals arising from visiting web pages. The annotated exploration history also allows them to rethink and reorganize their exploration process that has been carried out. In addition, the interactive history generates a knowledge map from the annotated exploration history, which map spatially represents the semantic relationships among the web pages explored. The knowledge map intends to facilitate reflection on knowledge that has been constructed during exploration.

This paper demonstrates the interactive history, and describes a case study whose main purpose was to analyze the utility of the interactive history. In this study, we observed an intensive rethink about exploration process including exploration goals particularly in a more complicated hyperspace. The results indicate that the interactive history facilitates goal-aware exploration and reflection for constructive learning in hyperspace.

Exploration in Web-based Learning Resource

In this paper, we consider learners who attempt to learn domain concepts and knowledge in a constructive way. Some learners may not make the cognitive efforts of knowledge construction. In this case, they may only browse or surf in hyperspace. Supporting such browsing or surfing is out of our scope.

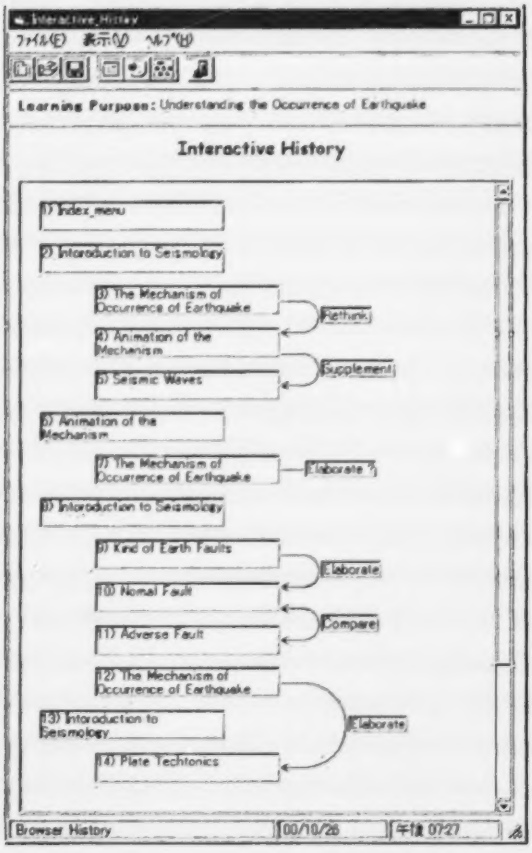

Figure 1: Annotated Exploration History.

Primary Exploration Process

In hyperspace provided by existing web-based learning resources, learners generally start exploring with a learning goal. The movement between the various pages is often driven by a local goal called exploration goal to search for the page that fulfills it. Such exploration goal is also regarded as a sub goal of the learning goal. We refer to the process of fulfilling an exploration goal as primary exploration process. This is represented as process from the starting page where the exploration goal arises to the terminal page where it is fulfilled.

An exploration goal may have several terminal pages with one starting page. Exploration goal, represented as verb, signifies how to develop or improve the domain concepts and knowledge learned at the starting page. We currently classify it into six goals: *Supplement*, *Elaborate*, *Compare*, *Justify*, *Rethink*, and *Apply*.

An exploration goal arising from visiting a page is not always fulfilled in the immediately following page. In such case, learners need to retain the goal until they find the appropriate terminal page/s. While searching for the fulfillment of the retained goal, it is possible for other exploration goals to arise. The need to retain several exploration goals concurrently makes the knowledge construction more difficult to achieve.

The exploration process can be modeled as a number of primary exploration processes. Let us give an example where a learner uses a hyperdocument on the Web with the learning goal of understanding the occurrence of earthquake. In this example, he/she explores a number of the web pages with various exploration goals. Figure 1 gives the exploration history, which shows the sequence of the pages visited and primary exploration processes. For example, he/she visited the page *Animation of the Mechanism* in order to rethink the description in the page *The Mechanism of Occurrence of Earthquake*. He/she then visited the page *Seismic Waves* since he/she did not know the meaning of the term used in the previous page.

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Knowledge Construction

In constructing knowledge, learners would make a semantic relationship among the domain concepts/knowledge in the starting and terminal pages of each primary exploration process, and then combine each semantic relationship to integrate a number of primary exploration processes (Thuering, Hannemann, and Haake, 1995). In educational hypermedia/hypertext systems with concept maps representing domain concepts to be learned, learners can derive such semantic relationship from the maps. Most existing web-based learning resources, on the other hand, do not specify the semantic relationship. The learners accordingly need to identify it by themselves.

The semantic relationship would be shaped according to the exploration goal. For instance, a learner may search for the meaning of an unknown term to supplement what is learned at the current page or look for elaboration of the description given at the current page. Each exploration goal provides its own way to make relationship between the starting and terminal pages (Kashihara, Ujii, and Toyoda, 1999). The knowledge construction process accordingly requires an awareness of the exploration goals.

Reflection

It is often difficult for learners to construct their knowledge since the primary exploration processes including exploration goals, which have been carried out so far, become hazy as the exploration progresses. Reflection on the primary exploration processes is accordingly involved in completing the knowledge construction (Thuering, Hannemann, and Haake, 1995). In the reflection, it is necessary for learners to rethink what and why they have explored. They should be particularly aware of the primary exploration processes. They may also need to reorganize the exploration process, which has been carried out (Kashihara, Ujii, and Toyoda, 1999).

Interactive History

The above consideration indicates that a goal-aware exploration should be encouraged, and that rethinking and reorganizing the exploration process that has been carried out should be supported. In order to give learners awareness of exploration goals and primary exploration processes, the interactive history system provides an exploration history that is annotated with exploration goals. It also provides a knowledge map, which visually represents relationships among the primary exploration processes, to help the learners to reflect on knowledge structure that has been constructed.

The interactive history system first enables learners to annotate an exploration history, which includes web pages sequenced in order of time they have visited, with primary exploration processes. In order to help learners note down the exploration goals, the system provides them with a list of exploration goals, and requires them to select one from the list when an exploration goal arises. The learners are also asked when they find the terminal page/s. The interactive history system annotates the exploration history with the information noted down. The annotated exploration history enables the learners to retain the primary exploration processes. The learners are also enabled to modify/delete the primary exploration processes and to add new primary exploration processes after exploring hyperspace. Such manipulation allows them to reorganize their exploration process.

The interactive history system second transforms each primary exploration process, which is extracted from the annotated exploration history, into a visual representation. It then combines each visual representation to generate a knowledge map. The knowledge map does not obviously represent the contents included in the explored pages, which may be summarized by the page titles. However, this summarized information would be substantially fruitful for learners to reflect on what they have learned.

Annotated Exploration History

In the interactive history system, learners use Web browser to explore hyperdocuments on the Web with one learning goal. When they want to set up an exploration goal in visiting a page, they are required to mouse-click the corresponding page in the *Annotated Exploration History* window. The *Exploration Goal Input* window then appears as shown in Figure 2. The learners can select one corresponding to the goal from the exploration goal list in the window. The page visited currently in the browser is also recorded as the starting page of the exploration goal. After inputting the exploration goal, the window disappears. In the hyperdocuments, the title tags of the pages do not always represent the contents of the pages. If the learners want to change the page titles, they can input new titles in

the *Exploration Goal Input* window. The pasted information and the changed page titles are also used in the annotated exploration history.

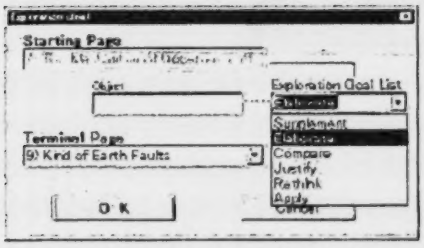

Figure 2: Exploration Goal Input.

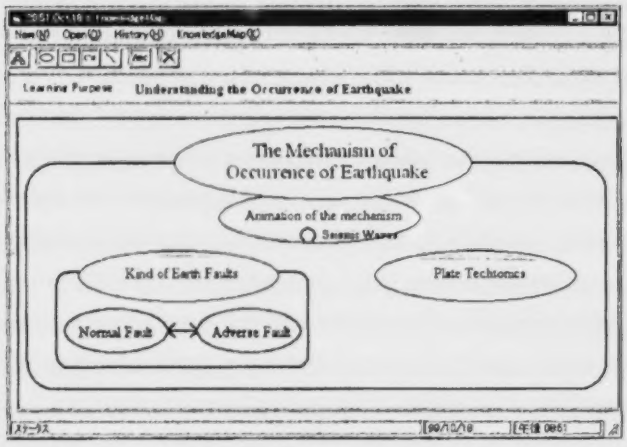

Figure 3: A Knowledge Map

When the learners find a terminal page of the exploration goal, they are required to mouse-click the exploration goal in *the Annotated Exploration History* window. The *Exploration Goal Input* window then appears. They can input the terminal page by dragging the title of the terminal page and pasting into the terminal page section in the window.

Using the information inputted from the learners, the system generates the annotated exploration history as shown in Figure 1 so that the primary exploration processes can be viewed clearly. In the annotated history, each page has its page title. The starting page of each goal is linked with the corresponding terminal page/s. There may be some primary exploration processes without terminal pages since they have not been found yet. The learners can look at the annotated exploration history on their demand during exploration.

Directly manipulating the annotated exploration history, learners can reconstruct their exploration process. Each manipulation is done by means of mouse-clicking/dragging parts of the primary exploration processes. There are three basic manipulations: deleting and changing exploration goals/links between starting and terminal pages, and adding new primary exploration process.

Knowledge Map

In order to make the knowledge map understandable, we have defined the correspondence of an exploration goal to a visual representation of the relationship between the starting and terminal pages. For example, an exploration goal to *Elaborate* is transformed into a set that visualizes the starting page as a total set and the terminal page as the subset. An exploration goal to *Compare* is also transformed into bidirection arrow between the starting and terminal pages. Following such correspondence, the system generates a knowledge map by combining visual representation of each primary exploration process in the annotated exploration history. The knowledge map generation is executed on learners' demand before/after manipulating the annotated exploration history.

Figure 3 shows an example of the knowledge map that is generated from the annotated exploration history shown in Figure 1. Viewing this map, the learner can recall that he/she elaborated *The Mechanism of Occurrence of Earthquake* by exploring *Kind of Earth Faults*, and that he/she furthermore elaborated it by comparing *Normal Fault* and *Adverse Fault*.

Case Study

The main goal of the case study was to analyze the utility of the system and to ascertain if the interactive history system facilitates reflecting on exploration process compared to learning without the system. We also

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prepared two web-based learning resources, which had comparatively simple (learning resource 1) and complicated hyperspace (learning resource 2), and ascertained in which resource the interactive history system enhances its own utility and facilitates reflection for knowledge construction more successfully. Subjects were thirteen graduate and undergraduate students in science and technology.

We set four conditions, which were (1) learning in the learning resource 1 with the system (Simple-With), (2) learning in the learning resource 1 without the system (Simple-Without), (3) learning in the learning resource 2 with the system (Complicated-With), and (4) learning in the learning resource 2 without the system (Complicated-Without). Subjects were provided with Internet Explorer as web browser under each condition. In this study, each subject learned one learning resource with the system, and learned the other without the system. In other words, he/she was assigned two conditions, which were Simple-With and Complicated-Without (or Simple-Without and Complicated-With). The assignment of the conditions was counterbalanced.

Before learning, subjects were given a learning goal for each learning resource. Under Simple-With or Complicated-With, they were also given the explanation about how to use the interactive history system, and were asked to try it in a sample learning resource whose hyperspace is simple. They were then asked to explore hyperspace with or without the system to accomplish the learning goal. The time of learning in each condition was limited to thirty minutes.

In this study, the utility of the system was analyzed with the dispersion of pages visited, the number of revisit per page (Tauscher and Greenberg, 1997), the number of primary exploration processes executed, and the number of revisiting pages that were included in the primary exploration processes. Comparing the averages of them under Simple-With and Simple-Without or under Complicated-With and Complicated-Without, we evaluated the utility of the interactive history system.

The results of the study are as follows. The average number of revisit per page on Complicated-With (1.83) was larger than that on Complicated-Without (0.89) although there was a slightly difference between Simple-With (1.95) and Simple-Without (2.07). The average dispersion of pages visited on Complicated-With (0.35) was lower that that on Complicated-Without (0.53) although there was a slightly difference between Simple-With (0.34) and Simple-Without (0.32). These results indicate that the interactive history system makes exploration more intensive in a more complicated hyperspace.

We further analyzed the utility of the interactive history system on Simple-With and Complicated-With. The average numbers of starting and terminal pages on Simple-With and Complicated-With corresponded to about half of the average numbers of pages visited (54.8% on Simple-With and 51.0% on Complicated-With). In other words, half of the visited pages were related to the primary exploration processes. The average numbers of revisiting the starting and terminal pages on Simple-With and Complicated-With accounted for 74.5 % and 79.9 % of the whole revisits. These ratios were very high.

From these results, we observe that goal-aware exploration and intensive revisits to the web pages in relation to the primary exploration processes were done particularly in a more complicated hyperspace. This suggests that the interactive history can promote reflection on primary exploration processes and their relationships. Although a more detailed investigation is needed, we guess that the aim of such reflection is to construct knowledge, which fulfills a learning goal, because of the high ration of revisits to primary exploration processes.

Discussion

Let us now discuss several points to notice in utilizing the interactive history. The interactive history system requires learners to input information about primary exploration processes that have been carried out. Such inputting, in addition, requires a meta-cognitive skill that is indispensable for managing knowledge construction process in existing web-based learning resources. The interactive history system could distract learners, who do not have it, from their learning tasks in hyperspace. We believe, however, it is educationally important to train the learners to improve the meta-cognitive skill so that they can learn in the Web. The interactive history can be viewed as a potential tool for this training.

Before using the interactive history system, in addition, learners need to know how to interpret the visual representation used for the knowledge mapping. In order to explain it, the interactive history system demonstrates few examples of annotated exploration history and knowledge map before starting the actual learning support.

Let us next compare with related work to consider the usefulness of the interactive history. The general Web browsers such as Netscape and Internet Explorer enable learners to revisit Web pages with back buttons and browsing history. However, these facilities do not always make the retention of their exploration processes easy. In particular, the browsing history provides no information of primary exploration processes that have arisen.

As the retention support, there are several kinds of annotation systems that allow learners to take a note (Brusilovsky, 1996). However, there is little discussion of what kind of annotation should be done for the success in constructive learning. In the interactive history, we claim that the reasons why learners search for the next pages should be particularly noted down.

Current work on adaptive hypermedia/hypertext systems has often provided spatial maps and concept maps as reflection support, which are originally used as navigational aid. Spatial maps can inform the learners where they are, what they explored, and to what extent they explored (Domel, 1994). However, the reasons why they visited are not clearly shown. Concept maps are more helpful for learners since the direction of knowledge construction is visible to them (Gaines and Shaw, 1995). However, learners, who particularly have higher capability of constructive learning, may identify semantic relationships among the domain concepts explored in a learner-centered way, which relationships may be different to those defined in the concept maps (Thuering, Hannemann, and Haake, 1995). In other words, they do not always construct the same knowledge structure as the structure of domain concepts that the designers of concept maps make.

The interactive history, on the other hand, can provide learners with a more proper support since it enables learner-centered exploration and generates a knowledge map according to their exploration process. In addition, the interactive history can also provide the reflection support even for most existing web-based learning resources of which concept maps are not prepared and even in ill-structured domains of which concept maps cannot be defined.

Conclusions

This paper has claimed that constructive learning with existing web-based resources requires learners to develop an awareness of not only what but also why they have explored. It has also stated that supporting it requires a learning tool promoting the knowledge construction involving reflection on their exploration process.

This paper has also demonstrated the interactive history, which encourages learners to do a goal-aware exploration. It enables them to annotate the exploration history with the exploration goals to rethink and reorganize their exploration process. It also generates a knowledge map from the annotated exploration history, which allows the learners to reflect on what they have constructed during exploration.

In addition, this paper has described an evaluation of the interactive history system. Although we need a detailed evaluation with more subjects, the results indicate that the system promotes the reflection on exploration process particularly in a complicated hyperspace.

In the future, we will have a more detailed evaluation. We would also like to classify exploration goals in detail to represent learners' exploration process more precisely.

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Information technology applications in creating University system of distance education

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Abstract. The kernel of DE system is a local network representing structure of the appropriate divisions of educational process. There are subsystems of preparation, submission and transfer of content, organization of its delivery, record and control of knowledge. Each subsystem represents two-level structure, which has outputs at the pupil and the teacher's level. The structure is organized by a principle of receiving of a profession (list of subjects for a concrete speciality). The internal structure of a subject represents the unified information system with appropriate content. Such approach allows to increase elements of DE system in accordance with their readiness (from the point of view of content) and to change the contents of separate specialties by a principle of blocks assembly. The application of the new technological achievements in telecommunication systems, in the software and hardware allows operatively using them for all elements of a subsystem. In Azerbaijan case at the first stage, the system is limited within large cities, by creation of terminals or terminal stations for the students. The teacher's party, i.e. preparation and transfer of content, is provided more with all necessary items, and this does not limit the level and quality of content submission.

The principles of the distance education, its structure are described in detail in literature. Our task is the creation the model and scheme of its realization on the assumption of maximum using of Internet technologies capabilities and increasing the quality of education. This model can be realized within frames of Republican system of higher education with hookup the same systems, but another levels of education (secondary, technical, vocational, etc.).

The approach is based on the postulate to approaching student to real environment of education with keeping of DE principles. This gives us to active implantation of information technologies into the process of creating and functioning of the system. This approach can be realized on the basis of maximum using of modern telecommunication capabilities and software for transferring and processing the contents.

There are some peculiarities of DE in Azerbaijan, which are related with level and degree of information technology development.

The local network is the DE system's kernel and represents the appropriate structures of educational process. These are subsystems of preparation, presentation, transfer of contents, organization of their delivering, record and control of knowledge. Each subsystem represents two-layers structure, which has outputs at the student and faculty level. The structure is organized by principle of specialty obtaining. That means the list of subjects for concrete specialty. In its turn, each subject is individualized from the faculty part. The inner structure of subject represents uniform information system with appropriate content.

Such approach gives to intensify the elements of DE system as their readiness (from the point of view of content) and to change the content of various specialties by principle of blocks construction. Introducing the new technological solutions into telecommunication systems, software and hardware allows quickly use the for all elements of subsystem.

When develop the system of DE in Azerbaijan, there is necessary to proceed from the existing level of development and covering of telecommunication services the whole population and from the level of its readiness. This situation limits the development level of the whole system and its covering capabilities. At the first stage the system is limited the frames of big and medium cities, by means the creating of terminals or terminal stations for students. The faculty part, e.g. prepare and transfer of content, more secure all necessary equipment? And that is not limited level and quality of contents presentation. As information technology development in Azerbaijan, the covering more and more territories with telecommunication services, the

possibilities and effectiveness of distance education will be increased. Calculations show that payments for distance education are covering today all expenses for creating and functioning the system.

Last developments of information technologies basically changed the concept and means of realization a lot of forms of human activities both in process management and education. In particular it related the methods and means of delivering, presentation and processing of information. Information systems created on the basis of newest technologies and telecommunication systems require the new approach to traditional means of education. Exactly new information technologies allow changing essentially the idea and realization of distance education.

Let's consider the system of distance education from the point of view of technical means of delivering and presenting of information. As the means of information delivering we can show here the following ones – printed information, audio, video, and digital. The latter is mainly used now for practically all forms of information. The printed one can be present in digital form and transmit over any electronic device. Just the same with audio and video information. The problem with traditional means of information is their interactivity. Only by way of digital methods of information delivery we can use the media as fully interactive ones. Only modern Internet system allows full two- and multiple-ways interactive communication between students and teacher.

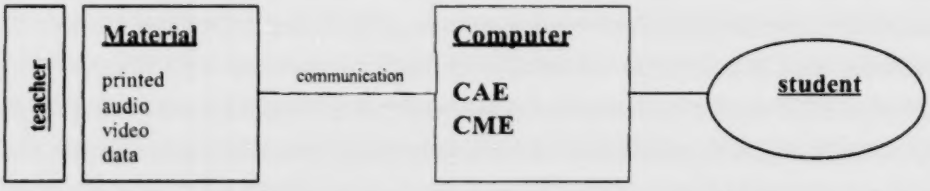
Computer applications for distance education are diverse and include themselves mainly the follow elements:

- Computer-assisted education (CAE) – here computer is considered as stand-alone machine for education purposes, for lectures, tasks, etc. It is used without help of instructor.
- Computer-managed education (CME) – here computer is considered as administration system, which mediate between students and teacher, create interactive links, accomplish control and manage all education process both for the whole course and separate subjects.

The first was used during initial transfer education materials into electronic form. There were programs, texts, case studies, etc. in those times there were not communication tools and interactive electronic systems, especially for student-teacher links. At the moment some courses are prepared for such type of education. It's so called self-education. We can consider it only as continued traditional vocational education, as early form of distance education.

The last one is the modern tool for really distance education, and allows us use completely all telecommunication advantages for education process. In includes itself the former, and go further on the information delivering and use. It is based on the telecommunication systems, all its capabilities and priorities.

As we see, in modern distance education system the main place is for computer and the mediator here is the communication system.



In this process the technical maintenance of information transfer determines the possibility and quality of education. As far as in reality, approximately to verily interaction between teacher and student can be done this process, the higher will be return, the process of knowledge getting. In this scheme we didn't show the main faces, those who create the possibilities of distance educatıon process, e.g. administrators, technical personnel, facilitators, those who do the process of transfer all forms of information from teacher to student, and those who determine the means and possibilities of information transfer.

Let's consider, what possibilities we have today for process of distance education from the point of view of technological maintenance. There are some technological elements that influence up to the distance education system in Azerbaijan. We have to choose which one can be used for every stage of creating the DE system. All these systems are considered only as elements of Internet, the means of delivering information.

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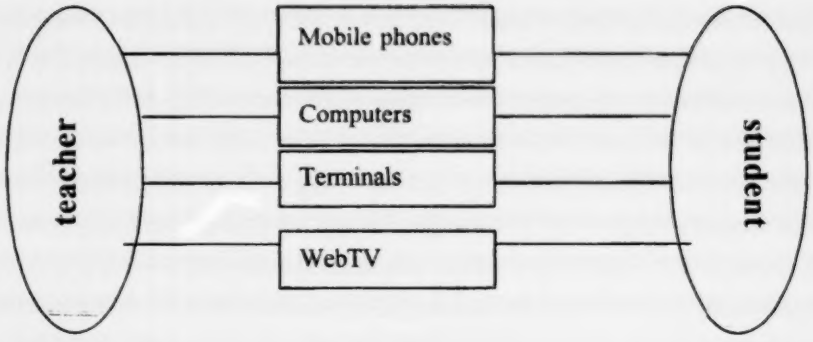

Technically today we have some variants of securing access to educational materials and interact with teacher – with the help of computer, mobile phones, terminals, and interactive TV. By cost they are ranged as terminals, interactive TV, computers, mobile phones. It influence on using them in the Azerbaijan system of distance education. We suggest that for real using the modern system of communication to explore at the first stage terminal stations for far student places. For cities, it may be using the computer systems (via Internet).

Because of expensive rates for mobile phones connection, the using of this device, as media, for getting information and working with it is impossible at the moment, although on the future with introducing the new mobile system this problem may be solved.

We are considering here standard running of distance educational system that was created within ASEU. Mainly it is working as part of the whole information system of the University and may operate under the main structure of educational system. This system consists from the following parts: secure database of educational materials, teaching blocks, and student blocks. Within these frames distance education system operates and uses the growing database of educational material. It includes itself as well the virtual library and faculty resources.

On the first stage the problem is the creation full and complex access of student to educational resources. Within frames of distance education system of ASEU it was realizing to simplify the education materials, as lectures, notes, tasks etc., to give students full knowledge about subject. From the technological point of view there were working out special forms for delivering materials via Internet and e-mail. We were trying to make easy for student to obtain all materials in such form they could print them and use out of terminals or other communication devices.

Especially there was given attention for students from regions, far areas, who have at the moment some problems with communication. As regards the citizens of big cities the problem is more easier for realization. They have access to Internet, and this way all contemporary materials were delivered and used by students.

Concluding this report I have to point out that the problem of technological aspect of distance education in Azerbaijan depends from the telecommunications development in Republic and , of course, the prices for their services. Till now they are higher than other CIS countries, not to mention European or North America countries. We hope that this process will be developed well and in future we can use all the technological capabilities of telecommunications and Internet.

All ISPs have appeared on the Internet-market relatively not so long ago, and to be exact, that peak of growth of the Internet-market of Azerbaijan has fallen to 1997-2001. The market has decently developed within four years. If in 1996-1997 there were no more than 5000 dial-up clients and no more than 50 dedicated channels, now the number has grown up to more than 70000 dial-up clients and about 300-370 dedicated channels. These parameters speak about the growing and developing market of the Internet. In comparison with other countries of the CIS Azerbaijan yields on these parameters only to the Baltic countries, Russia and Ukraine, though in percentage terms to the population we overtake Russia and Ukraine.

At the present stage of telecommunication development there is an international integration of financial and technological operational resources for the purpose of expansion of the number of communication services and

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scope new territories by these services. This process has demanded updating of all infrastructure of communication through creation the global information infrastructure.
The concept of updating consists of association of operational resources of information technologies and the advanced infrastructure of telecommunication for the purpose of interrelation and interaction of all users for receiving of any kind of the information in real-time without depending on the distance and usage of the technological means.

For Azerbaijan, with slowly advancing industrial sector, it is too early to think about manufacturing of the hi-tech telecommunication goods and services, but the world tendency of development of this market shows the necessity of creation of a power infrastructure, which further may become a springboard for creation hi-tech and IT manufactures. This shows the huge possibilities for communication development in Azerbaijan and their use for educational purposes. However, they not related so close each other, but relatively they influence highly on the level of technological securities of educational institutions.

The American experience in using advanced technological features of telecommunication systems in education gives us the way more effective at the each step of development, in particular applying distance education system with level of technological development.

Lessons Learned about Training Online Instructors

Greg Kearsley, Walden Institute, USA

Summary:
Since the summer of 1999, Walden Institute has offered a 3 month certified online instructor (C0I) program intended to provide faculty and trainers with the basic skills and knowledge needed to teach online courses. In this panel session, four faculty who have taught in this program, as well as at other institutions, will share their "lessons learned" about training online instructors as well as suggest guidelines for those creating their own programs. The audience will be encouraged to share their experiences from their own institutions/organizations.

Rationale for Session:
Online courses have become a major component of almost every major post-secondary institution, and corporate training department in the U.S. and world-wide. Teachers and trainers are expected to be able to teach these courses, even though they may have little or no actual experience with online learning/teaching. Yet everyone seems to agree that teaching online requires new skills and knowledge beyond those of traditional classroom instruction. However, there has been relatively little public or scholarly discussion about what these requirements are and how best to meet them. This session will provide an opportunity for such a discussion, using the Walden Institute COI course as a case study and basis for the discussion.

Questions/Issues to be addressed include:

- What are the skills/knowledge needed to effectively teach online?
- What is the best format for online instructor training?
- How long should an instructor training course be?
- How much web/internet/computer background does an instructor need to teach online?
- What are the typical problems that online teachers encounter?
- Are all teachers/trainers capable of being online instructors?

Background:
Most school systems post-secondary institutions have offered some degree of in-service training to their faculty, usually in the form of short workshops/seminars that provide introductions to online teaching. And many schools of education now have one or two courses about online education as part of their teacher training curriculum. But these efforts tend to be too brief and limited to provide the extensive, hands-on experience needed.

In 1999, Walden Institute began to offer a Certified Online Instructor (COI) course (see http://www.waldeninstitute.com/coi_ov.htm) intended to provide the kind of intensive training needed by teachers and trainers. COI is a 12 week, instructor-facilitated course offered entirely online. Separate course sections are offered for academic and training participants with slightly different course materials. To complete COI and earn

certification, participants must demonstrate their mastery of the following major competencies:

1. Basic elements of on-line courses: email, threaded discussions, real-time conferencing
2. Characteristics of distant, diverse, and adult learners
3. Qualities of effective on-line educators
4. Instructional and interface design considerations for on-line education
5. Different tools available for creating and managing on-line education
6. Strategies for integrating on-line and classroom instruction
7. Techniques for evaluating the quality of on-line learning courses and programs
8. Critical aspects of implementing a successful on-line course or program
9. Ethical and legal issues associated with on-line education
10. Emerging developments that will affect on-line learning

Over the twelve weeks, participants must complete a course design project that spans these topic areas and includes a working lesson prototype. During the course, participants are also given opportunities to serve as the facilitator of discussion forums and web conferences. Participants complete the program with a certificate validating that they are highly competent to teach online, as well as a course that they have designed and could implement for their institution or organization.

Since the course was first offered in 1999, more than 500 teachers and trainers from institutions and organizations across the U.S. have completed COI and been certified. Extensive course evaluation and follow-up data has been collected on COI graduates to assess the impact and effectiveness of the course. Here is a sampling of the kinds of comments graduates make:

Learning how to establish online curriculum was, by far, the most important and valuable thing I learned through the course. I never had experience in online instruction as a teacher so this was important for me as well as useful for the college level courses I teach.

I learned how important it is for instructors to interact with their students and provide timely responses during distance education classes.

Perhaps the most important thing I learned was the importance of advance preparation in developing an online course. Unlike face2face teaching, it is not so easy to modify teaching strategies in real time in the on-line world. It is very important to have materials and website implementation thoroughly debugged prior to launching the class.

One of the most important aspects that I learned was how important it is to be clear and detailed in your instructions and links.

It would be truly difficult to pinpoint one most important thing that I learned however I can say that: a) I gained a greater appreciation of how to make on-line teaching truly interactive; and b) I discovered that effective on-line teaching can come in so many different flavors.

How it feels to experience online learning from a student's point of view. I realize that this may not have been one of the stated objectives of the class, but now I've done the walk as well as the talk, and I feel that it's made me a much better instructor.

Dealing with planning issues--especially student-centered ones, is critical to the success of a course. Defining and managing expectations on both sides of the keyboard benefits both instructors and learners.

While we know from the feedback received that most COI participants are satisfied with what they learned in the course, and have applied their learning to their own teaching or training efforts, we don't know if the course could be designed more effectively, or that the particular competencies taught are the best ones. The course also does not provide a customized learning experience tailored to the pedagogy of particular individuals or institutions. When you take into account the tremendous diversity in teaching approaches and programs, it seems unlikely that the same training program would work for a broad range of teachers/trainers. On the other hand, COI provides a community of learning for teachers where they can share and acquire ideas from each other – making it possible to cultivate diverse perspectives.

Panelists:

Ray Thron

At Walden Institute, Raymond W. Thron develops and implements online instruction in research methodology, technology skills, and in teaching strategies in the online environment. He also serves as the academic director for Walden University's residency program and is a faculty mentor in the health services program .

An eight-year veteran of developing and conducting training programs, Thron has gained his experience by combining two passions: a love for learning and a love for the environment. Through his extensive involvement with environmental organizations during the last twenty-five years, Thron has conducted training for individuals from Poland to India on pollution prevention and waste management, and provided training in Eastern Europe on occupational and environmental health, pollution control, waste management and water supply activities.

In addition, he teaches an online course for Howard University as part of its Prospective Future Faculty Program, and has distinguished himself as a speaker on teaching in the online environment. Thron is also a principal with Walth Faculty Associates, a small consulting firm in the Minneapolis – St. Paul area.

Thron holds a Ph.D. and master's degree in environmental health from the University of Minnesota, as well as a bachelor's degree in civil engineering.

Marilyn Simon

Marilyn K. Simon's vast career in education spans more than 30 years. In those 30 years, Simon has made significant contributions in the areas of education technology, curriculum development and assessment, mathematics education, and adult continuing education. Simon is currently an independent educational consultant for the University of California, California State University, and South Australia University, among many

other education institutions. She is also an online instructor and facilitator for the University of Phoenix, Baker College and Upper Iowa University.

Prior to establishing her own business, Simon served as systems analyst for Sharps Hospital in San Diego, Calif., where she designed and implemented continuing education programs for laboratory personnel. She was also an instructor of mathematics at the graduate, undergraduate and high-school levels. She is currently an ambassador for Mathematics Education in South Africa.

Simon holds a Ph.D. in the philosophy of education, with a specialization in mathematics education, from Walden University, a Master of Science degree in mathematics teaching from The Illinois Institute of Technology and a Bachelor of Arts degree in mathematics and education from the City of New York University, Brooklyn College. She has conducted post-doctoral research in Women and Mathematics at the Institute of Advanced Studies in Princeton, New Jersey, and has also done extensive research in Chaos Theory.

John Peters

John Peters' background in training spans nearly two decades. The journey to becoming a seasoned educator began when John was a police officer in the 1970s. He became a self-defense specialist and began teaching other officers. He quickly transitioned from a police officer into one of the nation's top defensive tactics instructors as well as into an expert in the management of criminal investigations.

Through his company Defensive Tactics Institute, Inc., Peters currently designs, implements and evaluates instructor and basic training programs for criminal justices agencies across the globe. He is also on the faculty of Millersville University, Eastern College--where he is designing an online course in the Management of Information Systems program--and Northern Essex Community College.

Peters holds a Ph.D. in applied management and decision sciences from Walden University, a Master of Business Administration degree from Babson College, a Master of Science degree in public relations from Boston University and a Bachelor of Science degree in criminal justice from the University of Baltimore.

Linda Crawford

Linda Crawford received her Bachelor's degree from Emmanuel College, Boston, MA and her Ph.D. from the University of Minnesota, with a dissertation focused on the work of Paulo Freire. She has held positions at all levels of education, elementary, secondary, undergraduate and graduate, and in both public and private schools. Having served as a teacher, department chair, dean of students, high school assistant principal and junior high principal, she currently is Assistant Superintendent of Instructional Support Services for a large metropolitan area school district in Minnesota. In that capacity, she is responsible for: curriculum and instruction; research, evaluation and assessment; instructional media and technology; special education; state and federal programs;

English as a Second Language; and desegregation initiatives. She has published and presented locally, regionally, and nationally on topics of curriculum, educational philosophy, and administration.

Dr. Crawford teaches online courses for several institutions in the areas of research, statistical analysis, curriculum, instruction, and assessment. In addition, she has written a number of graduate courses for online delivery on topics of curriculum theory and design, educational measurement and evaluation, and instructional practice. She is guiding an initiative within her school district for online staff development and web-based delivery of high school level courses.

A Web Plug-In that Empowers Students and Faculty Online: The Columbia University Analyzer

Ryan Kelsey, Columbia University, USA ; Peter Sommer, Columbia University, USA

The Columbia University Analyzer (CU Analyzer) is a special, customized edition of hyperfolio, a revolutionary web tool developed by Learn Technologies Interactive, Inc. that takes a step toward providing students with an online toolset for analysis and expression of multimedia found on the Internet. The CU Analyzer is a unique web-based tool that allows one to capture, analyze, and ultimately express new knowledge using multimedia objects culled from anywhere on the web. It is a true departure from typical digital tools as it empowers the user to control his or her online experience through the use of a personal digital portfolio, effectively a private collection controlled by the user. No longer is the online experience limited to surfing, browsing, bookmarking, or elaborate downloading schemes. With the CU Analyzer, users can quickly create their own web-linked multimedia expressions using content from any website. Columbia University's Center for New Media Teaching & Learning (CCNMTL) is working with Learntech to customize hyperfolio into a powerful tool for academic users of the web. The CU Analyzer has the potential to radically alter the culture of use surrounding the Internet.

Learner Supports in Rural Communities: the Key to Student Success in the On-line Environment

By

Adrian Kershaw

Abstract

Typically, rural residents find the available technology infrastructure is limited and low incomes mean that students do not have access to up-to-date equipment at home. In addition, an historic focus on employment in resource industries has meant that education and training is not valued as a route to personal economic well-being. Clearly, in an increasingly knowledge-based economy this puts rural residents at a distinct disadvantage. To help would-be students overcome these challenges, the University College of the Cariboo (UCC) is implementing a network of Distance Learning Study Centres across its region. These Centres provide a suite of learner supports all aimed at ensuring successful course and program selection. From UCC's perspective, it does not matter where the courses or programs come from – community development is the objective. Thus, students taking courses on-line from other institutions receive the same levels and types of support that UCC's own students would receive at these Centres. Students are able to use each Centre's technology, receive instruction in the use of software, access library and counseling services, receive study skills support, use group study space, and are provided with prompting and support to keep them on track.

Information Area Tracking and Changes Summarizing System in WWW

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Abstract: Due to its open characteristic, the Web is being posted with vast amount of new information, or Changes continuously. Consequently, at any time, it is conceivable that there will be hot issues (emerging topics) being discussed in any information area on the Web. However, it is not practical for the user to browse the Web manually all the time for the Changes. Thus, we need this Information Area Tracking and Changes Summarizing System (ATSS) as an information agent, to detect the Changes in the information area of our interest and generate a summary of Changes back to us regularly. This summary of Changes will be telling the latest most discussed issues and thus revealing the emerging topics in the particular information area.

1. Introduction and Related Work

User or professional would like to be always updated with the latest hot topic emerging in the particular information area of their interest. However, due to the information on the Web is overwhelming and changing dynamically, updating ourselves by browsing through some particular Web sites of interest manually and regularly is both a difficult and time consuming job. Thus, we need a kind of information agent which can track and acknowledge us upon changes took place on the pages or information area of our interests.

There are quite a number of commercial tracking tools (Santi98) have become available for online services. Basically, when users want to track a particular html page on the Web, they need to register the URL of the page with the system. And upon any changes happen on the page, they will be acknowledged through email. However, output from concurrent tracking systems always show little or no information on how the pages have changed. Thus, the AT&T Internet Difference Engine (AIDE) (Douglis98) has been contributing in solving this problem by automatically compares two html pages and creates a "merged" page to show the differences with special HTML markups. Other than tracking some specified URLs, some systems, i.e. Informant (http://informant.dartmouth.edu/) and Netmind (http://www.netmind.com/) are featured to detect the new pages containing the user input keywords.

In general, the conventional page trackers only tell that some pages have been updated or some pages are new. Users are left alone to figure out themselves what are the main topics behind the changes. At this point, we still lack of a tool that can track a particular information area of user's interest, collect the Changes regularly, and generate a summary of the most discussed issues from the Changes back to the user regularly.

2. System Architecture

Figure 1 illustrates the system architecture of ATSS. ATSS consists of three main components: Area View System (AVS), Web Spider and Changes Summarizer. After taking in an input keyword from the user, AVS will direct the keyword to the commercial search engine Google (http://www.google.com/). Then, AVS will analysis the returned hits and derive a number of *domains* that are most related to the keywords. These domains are grouped together to form an information area devoted to the keyword. Then, the Web Spider will dispatch to the Web to scan all the html files in these domains regularly, in order to collect all the modified and newly added html pages. Then, the Changes Summarizer will extract all the Changes (newly added sentences) from the collected html files by comparing the old and new database. Then, a new algorithm TF*PDF (Term Frequency * Proportional Document Frequency) (Equation 1) will be used to count the weight of the terms in the Changes. This new algorithm is

innovated in a way to give more weight to the terms that deem to explain the most discussed issues in the Changes. Lastly, sentences with the highest average weight will be extracted to construct a summary for the user.

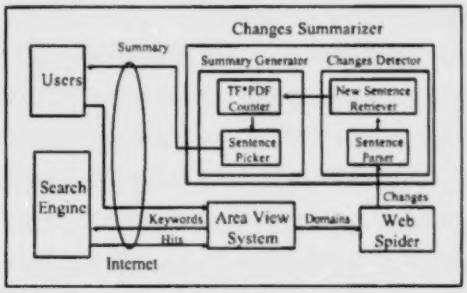

Figure 1: ATSS System Architecture

2.1 Area View System

Area View System will direct the user input keyword to the search engine Google and collect all the hits. Each hit has a unique URL that may consist of a domain URL, a path, and a file name together. For example, the page http://www.cns.miis.edu/research/nuclear.html has a domain URL of http://www.cns.miis.edu/, a path of research/ and a file name of nuclear.html. From all the returned hits, AVS will further derive 50 salient pages with their domain URL occur most frequently. Salient page is the top page of a domain if the domain has its overall contents relevant to the keyword. But some of the domains have only a sub-directory devoted to the keyword. In this case, the salient page will be the top page of the sub-directory. AVS determines this salient page as whether the top page of a domain or the top page of a sub-directory in the domain by analyzing the shortest common path of the hits originated from the domain. If all the hits originated from a domain have a shortest common path, then the salient page is the top page of the sub-directory with the name of the path. The principles on how AVS can determine the salient page is illustrated in Figure 2.

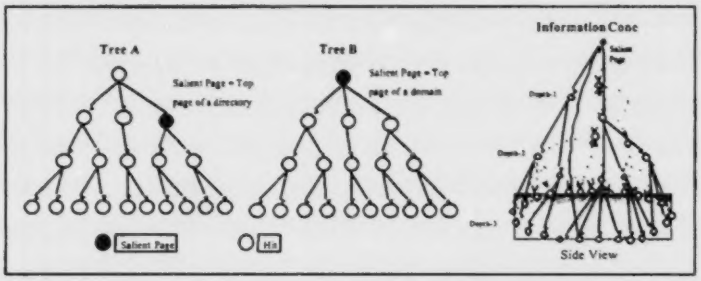

Figure 2: Domain Tree and Information Cone

Figure 2 illustrates two different trees representing two domains. Each node represents a web page in the domain. In tree A, all the hits have a common path that is a top page of a sub-directory. In this case, the top page of the sub-directory is the salient page. While in Tree B, there is no shortest common path, so the salient page is the top page of the domain. Now, we can imagine that the combination of a salient page and all the pages under it shape an information cone as showed in Figure 2. This cone provides a more comprehensive structural representation than a tree. Salient page is always at the tip of the information cone.

However, by just analyzing the URL's frequency in determining the domains for tracking usage is insufficient. Hence, AVS will do a more detail analysis on the information cones in order to identify the real information cones with high suitability. The suitability of an information cone will be calculated by the Suitability Equation showed below. Suitability of an information cone is equal to its Link Ratio plus File Ratio. All the information cones with suitability more than a certain trigger level will be added into the list of information cones used for tracking purpose.

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$$Suitability = \frac{total\ outer\ links\ pointing\ into\ other\ information\ cones}{total\ outer\ links} + \frac{total\ number\ of\ pages\ containing\ keyword}{total\ number\ of\ pages}$$

2.2 Web Spider

Web Spider is an autonomous robot that dispatches to the Web regularly to scan all the qualified information cones for new and updated html pages. Basically, Web Spider adapts Breath-first search algorithm (Russell95) to traverse through the information cones.

2.3 Changes Summarizer

Changes Summarizer is designed to analyze the updated and new pages collected by the Web Spider, derive the Changes and generate a summary of emerging topic from the Changes. Changes Summarizer consis ts of two major components: Changes Detector and Summary Generator. Changes Detector is designed to derive the Changes from the collected HTML pages. Changes is defined as a collection of text files containing all the sentences appear in the new pages but not in the old pages. Changes Detector will first wipe out all the html tags and parse the html pages in sentences text file. Then, it will compare the old and new version of sentences text file in order to derive the Changes. Then, Summary Generator will be used to generate a summary from the Changes. Summary Generator consists of two components: TF*PDF Counter and Sentence Picker. TF*PDF Counter will count the significance (weight) of the terms in the Changes by the new TF*PDF algorithm. Terms are normally content words. Stop words like prepositions (i.e. in, from, to, out) and conjunctions (i.e. and, but, or) are eliminated via a general stop word list. Different from the famous TF*IDF (Salton98) algorithm, in TF*PDF, the weight of a term in a domain is linearly proportional to the term's within-domain frequency, and exponentially proportional to the ratio of document containing the term in the domain. The total weight of a term will be the summation of term's weight from each domain.

In the final stage, Sentences Picker will calculate the average weight of each sentence in the Changes. The sentences with highest average weight will be used to construct a summary.

$$W_j = \sum_{d=1}^{d=D} \left|\overrightarrow{F_{jd}}\right| \exp\left(\frac{n_{jd}}{N_d}\right) \quad \rightarrow (Eq.1)$$

$$\left|\overrightarrow{F_j}\right| = \frac{F_j}{\sqrt{\sum_i (F_i)^2}} \quad \rightarrow (Eq.2)$$

W_j=Weight of term j;
F_{jd}=Frequency of term j in domain d;
n_{jd}=Number of document in domain d where term j occurs;
N_d=Number of document in domain d;
k=total number of terms in a domain;
D=number of domains under tracking.

3. Experiment

A keyword of "e-commerce" was used. There were 20 salient pages derived by Area View System with the help of the commercial search engine Google. Changes happened during the time interval in between Oct 3, 2000, Nov 3 and Dec 4, 2000 was collected. Table 1 shows the experiment data. In the first column are the URLs o f the salient pages, and the names of the respective domains are recorded in the second column. Third and fourth columns show the File Ratio and Link Ratio of each information cone respectively.

Table 2 shows the top 30 most weighted TF*PDF terms in the Changes from Oct 3 2000 to Nov 3 2000. Table 3 shows the top 30 most weighted TF*PDF terms in the Changes from Nov 3 2000 to Dec 4 2000. From the data, we found that there are 16 terms remain in the top 30 most weighted terms. There are Internet, online, information, click, Web, new, business, companies, customer, technology, e-commerce, use, customers, electronic, experience and site. Among them, the term "Internet" gained and remained the term with highest term weight. This

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concurs with the fact that the Internet is the vital way in doing electronic commerce. From the data, another important point that we realized is that the term "privacy" was not one of the terms in Table 2, but it appeared as one of the top 10 most weighted terms in Table 3. This shows that privacy had become one of the new important issues. The resulted 3 sentences with highest average weight are as in Table 4.

The highlighted terms in Table 4 are among the 30 most weighted terms. In the first sentence, it tells that the Internet changes any kind of business doing online, which is electronic commerce. In the second sentence, it tells that U.S. government is unlikely to force electronic signatures implementation in Internet business transactions. And the third sentence concerns Web privacy practices.

Salient Page	Name	Suitability	
		File Ratio	Link Ratio
http://ecommerce.internet.com/	Electronic Commerce Guide	0.894	0.022
http://www.commerce.net/	Commerce Net	0.643	0.006
http://www.ecominfocenter.com/	eCommerce Info Center – One Stop for eCommerce Info, Services, products and technologies	0.796	0.005
http://www.goodexperience.com/	Goodexperience.com	0.666	0.003
http://www.anu.edu.au/people/Roger.Clarke/EC/	Roger Clarke's Electronic Commerce	1	0.013
http://www.emarketer.com/	eMarketer – the world's leading provider of internet statistics	0.996	0.004
http://cism.bus.utexas.edu/	Center for Research in Electronic Commerce, UT Austin	0.575	0.003
http://ec.fed.gov/	Electronic Commerce Home Page	0.475	0.002
http://special.northernlight.com/ecommerce/	Northern Light Special Edition : Electronic Commerce	1	0.041
http://ecom.das.state.or.us/	Oregon Center for Electronic Commerce & Government	1	0.013
http://www.becrc.org/	Electronic Commerce Resource Center (ECRC), Bremerton WA	0.801	0.020
http://www.ecommercetimes.com/	E-Commerce Times: the E-Business and Technology Super Site	0.997	0.002
http://www.cio.com/forums/ec/	E-Business Research Center - Electronic Commerce Research Center	0.5	0.008
http://www.cptech.org/ecom/	CPT's Page on Electronic Commerce	0.681	0.016
http://www.diffuse.org/	Diffuse – Home Page	0.993	0.003
http://www.ec2.edu/dccenter/ecommerce/	EC2@USC - Digital Commerce Center – Electronic Center	0.723	0.017
http://www.ecommercecommission.org/	Advisory Commission on Electronic Commerce	0.827	0.001
http://www.ecomworld.com/	Electronic Commerce World	0.605	0.001
http://www.ecrc.uofs.edu/	Scraton ECRC	0.431	0.002
http://www.epic.org/	Electronic Privacy Information Center	0.883	0.010

Table 1: Experiment domains

TERM	WEIGHT	TERM	WEIGHT	TERM	WEIGHT
Internet	2.859	business	1.212	looking	0.888
Web	2.093	click	1.185	b2b	0.885
information	1.818	topic	1.151	type	0.881
online	1.73	customers	1.001	electronic	0.881
new	1.524	terms	0.994	just	0.864
companies	1.493	logistics	0.94	word	0.85
e-commerce	1.42	XML	0.909	2000	0.835
search	1.398	definition	0.905	letter	0.833
customer	1.238	use	0.894	experience	0.824
glossary	1.23	technology	0.891	site	0.804

Table 2: TF*PDF Terms with highest weight (Oct 3 – Nov 3)

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TERM	WEIGHT	TERM	WEIGHT	TERM	WEIGHT
Internet	2.927	global	1.51	electronic	1.122
online	2.835	technology	1.432	said	1.077
information	2.224	ecommerce	1.23	policy	1.045
click	2.139	Services	1.197	users	1.033
Web	2	e-commerce	1.184	experience	1.015
new	1.782	company	1.184	local	0.974
business	1.772	use	1.161	site	0.971
companies	1.583	customers	1.15	licensing	0.922
privacy	1.568	service	1.145	notices	0.912
customer	1.52	legal	1.132	permissions	0.9

Table 3: TF*PDF Terms with highest weight (Nov 3 – Dec 4)

Top Sentences	Average Weight
Regardless of what your **company** is doing **online** -- **information technology**, content or **e-commerce** -- as the **Internet** changes so does your **business**.	1.136
No one, including the U.S. government, seems to believe that the government should force **Internet companies** to use **electronic** signatures for **Internet** transactions.	0.958
One of the leading **Web privacy** practices is the use of a **Web site privacy policy** to explain what a **company** does with personal **information** gathered on the **site**.	0.957

Table 4: Result Summary

4. Experiment Result Verification

Figure 3: CNN News April 17 2001

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Figure 4: CNN News May 25 2001

In Figure 3, it was reported that more than 60 federal Web sites violates U.S. privacy rules by using unauthorized software to track the browsing and buying habits of Internet users. While in Figure 4, it tells that because of under pressure to protect privacy better, advertising industry has set up two new Web sites that let computer users refuse to have their personal data collected and profiled when they visit popular commercial Web sites. These two figures with the news emerged few months after the experiment done, agree with the experiment results that privacy would be a hot issue or an emerging topic discussed widely.

5. Discussion

The objective of this work is to innovate an intelligent Internet software application to derive the emerging topic (hot topic) in a particular information area in the Web. Due to the Web is open and dynamic, contents in any information area is changing dynamically. Consequently, at any time, it is conceivable that there will be some hot issues being discussed and posted in any information area on the Web. The newly posted information is defined as Changes to that information area. And the system that we proposed, ATSS, is to retrieve this Changes and derive an emerging topic from it.

6. Conclusion

In this paper, we have proposed a novel system, ATSS, and evaluated it by putting a proper experiment in place. To have this system reporting us the most updated topics related to our keywords regularly, we are "all time aware" of the latest trends in the information area of our interest.

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A Complexity Metric for Web Documentation Based on the Entropy

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Abstract

In this paper, We propose a metric model for measuring complexity of Web documentations which are wrote by HTML and XML. The complexity of Web documentation has effect on documentation understandability which is an important metric in maintenance and using of Web documentation development. The understandable documents have more effect on WEI. The proposed metric uses the entropy to represent the degree of information flows between Web documentations. The proposed documentation complexity measures the information flows in a Web document based on the information passing relationship between Web document files. We evaluate the proposed metric by using the software complexity properties proposed by Weyuker, and measure the document complexity. We show effectiveness of analyzing the correlation between the number of document file and document complexity.

I. Introduction

Under the Internet environment, many Web documenatations have been produced. Many users have searched and understood them. Web masters have feeling difficult on understanding these documentations owing the complex links between the web documentations. However, there is few study on criteria of making the web documentations, or metrics of the web documentations.

So, there is no guideline of writing the web documentations considering the understandability for the web documenatations

It is very important to understand the web documentation in order to maintain and use the web documentation.

A good complexity metric for the web documentation could be used as a quality assurance by web documentation developers and even as customers, and could be possible to plan and to control web documentation development process.

Now, web documentations are evaluated on quality. Hope N. Tillman[1] proposed the criteria on the web documentation which are authority, accuracy, objectivity, currency, and coverage. Alexander, Jan, and Marsha Tate[2]'s reseach result and Beck, Susan[3]'s research result make a checklist for the web documentation.

There, therefore, is an increasing need for the web documentation complexity metric to help to plan and to control the quality in web documentation development.

These complexities are lack of measuring the information flows between web documentations which is very important for understanding them. Therefore, in this paper, we propose that the web documentation complexity measures the information flows between web documentation's components based on the information passing relationship among web documentations.

The proposed metrics use the entropy concept to represent the degree of information flows in the web documentations.

In the next section, we describe the concepts of the Entropy. The third section describes the method measuring web documentation. In the fourth section, we explain the properties of the proposed metric. In the fifth section, we evaluate the proposed metrics by using the software complexity properties proposed by Weyuker. In the sixth section, Experimental results of web documentationes show the effectiveness of the proposed metrics. The conclusion is described in the final section.

2. Definition and Entropy Theory

2.1 Definitions

In this section, we explain the definition easily . In general, in making web documentation, there are many web documentation files. So, we define the document as 1 and more document files as following definition 1.

Definition 1: Document
<Document> = <Document file>+

Document file has one HTML file. So, we define the document file as following definition 2

Definition 2: Document file
<Documents file> = < X.html>

X means file name.

2.2 Entropy theory

Shannon's entropy theory[3], which has been mostly used on information processing and signal processing, describes the degree of disorderliness. This theory has been applied on measuring the complexity of software[4][5][6]. These measures were developed by adapting the information theoretical notion of the Entropy as a measure of uncertainty or variety. According to Shannon's definition, when a signal is used to convey information the higher the uncertainty associated with the signal, the greater is the amount of information conveyed by the signal. That is to say, when transmitting arbitrary messages of web documentation, the information quantity of messages that is often transmitted is lower than what is not often transmitted.

The following expression 1 is defined to measure the self-information quantity as a logarithm function of the probability of occurrence of a certain message. If M is the message set(M1, M2, M3 ,,,,,, Mn) from which the message can consist of, the self-information of the message Mi is

$$I(M_i) = -\log_2 P(M_i)$$ ---------- expression 1

The value of entropy is calculated by averaging the self-information over all messages in M message set. Therefore, The entropy function is derived from the expression 1, and is given by the expression 2 :

$$H(M) = E[(M_i)] = \sum_{i=1}^{n} I(M_i) \times P(M_i)$$ -expression 2

According as the web documentation consists of texts and links, links are added to the web documentations , the relationship of components in the web documentation is complex. Thus, it is difficult to understand the web documentation, and the web documentation complexity is increased. This result means that the entropy increases if the message is added in the entropy function. Therefore, we can use the entropy function to measure the web documentation complexity.

3. Complexity

A web documentation consists of texts and links by the HTML or XML. I study on the set of the web documentations that are 1 and more the web documentation file. The HTML web documentations are linked between the web documentation file. These linked web documentations increase the web documentation complexity. Therefore, the web documentation complexity have been effect on the number of web documentation files and the number of the link between the web documentation files. So, I define the web documentation complexity according to the number of web documentation files and the number of links between the web documentations.

At first, I define DR graph(Document File Relationship graph) that represents the relationship between the web documentations.

Definition 3 : DR graph
DR(D)=<N, A, R>
where N is the set of documents, A is the set of arcs with weight, and R is relation between documents

We can consider the DR graph as the directed graph. Then, we formalize the DR graph very easily. This graph consists of three sets : (1) The finite sets N of element called nodes that consist of the web documentation files, (2) the finite A set of element called

arcs that represent the relationship between two nodes and have weight, and (3) a relation R : A --> N ¡¿ N which maps each arcs A into an ordered pair(p, q) of nodes called its ends. We use the symbols N1, N2 ,,,,Nn to represent the nodes of the DR graph, and the symbols A1, A2 ,,,,An to represent its arcs . If Ak=(Ni, Nj), the Ni is called the initial node of the arc Ak and the Nj is called as the terminal node of the arc Ak. If Ak=(Ni, Nj) relation exist, the weight of the arc Ak is the number of frequency of which its initial node Ni calls or refers its terminal node Nj.

Given the web documentation, there are nodes for the web documentation files. The arc represents dependency between the web documentation files. Its weight represents the number of frequency that the web documentation refer each ohers.

In order to measure the web documentation complexity, i construct the DR graph from the web documentation, calculate the reference probability of all nodes, and measure the web documentation complexity using the Entropy function and the reference probability of all nodes. The detailed explanations will be described at next paragraphs. At first, the DR graph is constructed from the web documentation. This algorithm consists of three steps. The first step is to make nodes from extracting the web documentation files from the web documentations. The second step is to determine the arcs and the weight of the arcs between nodes. If the node Ni is called by node Nj or calling the node Nj, there exist an arc between two nodes. The weight of the arc is determined by the number of frequency that the node Ni refers the node Nj or is referred by the node Nj. There exists an arc between the node N1 and the node N2, its initial node is node N2, and its terminal node is node N1. The weight of this arc (W(A21)) is 1. According to the above method, the weights of all arcs are determined.

For example, we assume the following html documenatation. This Web docuementation consists of 8 documentation files.

<Documents> = <index.html>+<com.html>+<result.html>+<error.html>+<source.html>+<reset.html>+<output1.html>+<output2.thml>

<index.html>=<A HREF= "com.html">+ <A HREF="result.html">+<A HREF= "error.html"> +<A HREF= "output1.html">+<A HREF= "output2.thml"> +<A HREF= "reset.html">

<com.html>=<A HREF= "index.html">

<result.html>=<A HREF="index.html">+<A HREF="source.html">

<source.html"> +<A HREF= "com.html">+<A HREF= "error.thml">

Above documentation structure, if index.html file is node1, and error.html file is node2, there exists a acr between node 1 and node 2. This arc is expressed by E2,1, and the arc's weight is 1. All nodes and arc are decided by this mehod. Figure 1 is constructed from theses method.

At second, we measure the reference probability of all nodes of DR graph. The reference probability of node Ni is defined as the expression 3

$$P(N_i)=\frac{\sum_{j=1}^{n} W(A_{i,j})+\sum_{j=1}^{n} W(A_{j,i})}{2\times\sum_{k=1}^{n}\sum_{j=1}^{n} W(A_{k,j})} \quad \text{expression 3}$$

The number of total nodes of the DR graph is n. Without arcs between the initial node Ni and the terminal node Nj, The value of $W(A_{i,j})$ is 0. The total weight of all arcs connected the node Ni is $\sum_{j=1}^{n} W(A_{i,j})+\sum_{j=1}^{n} W(A_{j,i})$. The total weight of all arcs connected all nodes of the DR graph is $\sum_{k=1}^{n}\sum_{j=1}^{n} W(A_{k,j})$.

The Table 1 shows the reference probability of all nodes of the Figure 1.

At last, the web documentation complexity is measured by applying the reference probability of all nodes to the entropy function. The web documentation complexity of the above example is 2.6244.

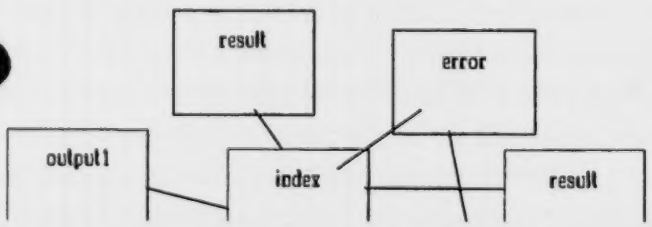

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Figure 1. the DR graph

Table 1 The Reference Probability of Figure 1

The name of node	The reference probability
Index	0.364
Source	0.136
Result	0.136
Com	0.136
Reset	0.045
Output1	0.045
Output2	0.045
Error	0.091

4. Properties of complexity

Property 1 : The maximum of class complexity and inter-object complexity = $\log_2 N$

Assume that the number of nodes of the DR graph of the web documentation is N and the number of its edges is E. The condition of maximum entropy is that the reference probability of all nodes of the DR graph are equivalent. So, the reference probability of each node is as follows: P(N1)=1/N, P(N2)=1/N,,,,,,P(NN)= 1/N. The maximum of the web documentation complexity is calculated by the expression 6. Therefore, the maximum of the web documentation is $\log_2 N$

$$H = -\sum_{i=1}^{n}(\frac{1}{N})\log_2(\frac{1}{N}) = \log_2 N \quad \text{----expression 6}$$

Property 2 : The minimum of class complexity and inter-object complexity = 0

In case that the number of nodes of the DR graph is 1, the minimum of entropy is measured. Given that a web documentation consists of a node, If a node is the web documentation file. If the web documentation file is the self linked web documentation, the reference probability of the node is 1. If the web documentation has no linked web documentation, the reference probability of the node is 0. Thus, P(N) is 0 or 1. As $P(A_1) = 0$ is satisfied , in case that the reference probability of a node is 0, the value of the expression 7 is 0. As $\log_2(1) = 0$ is satisfied, in case that the reference probability of a node is 1, the value of the expression 7 is 0.

$$H = -\sum_{i=1}^{n} P(A_i)\log_2 P(A_i) = -P(A_1)\log_2 P(A_1) \quad \text{---------- expression 7}$$

Therefore, the minimum of the web documentation complexity is 0.

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5. Verification

Generally, complexity validation has been evaluated by complexity properties that Weyuker[8] proposed. Of course, Weyuker's complexity properties are not sufficient conditions of the software complexity[9], but has been evaluated by a number of the existing software metrics[10][11]. But, there is no criteria of evaluating the web documentation complexity. So, the web documentation complexity will be evaluated by using the criteria of Weyuker's complexity properties.

When the web documentation complexity is evaluated, we assume that the ***P*** is a web documentation complexity of the P web documentation and the ***Q*** is a web documentation complexity of the Q web documentation.

Property 1. *(¢¤P)(¢¤Q)(|P| ¡Á|Q|)*

The property 1 shows the intuition that not all web documentation should have the same web documentation complexity.

In case of the web documentation complexity, assume that the number of links(nodes) of two web documentations are different. The DR graphs of two web documentations are different. the reference probability of all nodes of two DR graphs are different. Therefore, the web documentation complexity of two web documentation can be different. There exist the web documentations whose class complexity are different.

Property 2. *There are a finite number of* web documentations *having the same complexity value.*

Since the number of web documentation is finite at any system, the web documentation is finite. Thus the web documentation complexity proposed in this paper satisfy the property 2.

Property 3. *(¢¤P)(¢¤Q)(P¡ÁQ & |P|=|Q|)*

The property 3 means that even if the web documentation complexity of two web documentations are same, they can exist as different web documentation which has node of DR graph, the different web documentations which has different functionality can be existed.

So, the web documentation complexity satisfies the property 3 clearly.

Property 4. *(¢¤P)(¢¤Q)(P = Q & |P|¡Á|Q|)*

The property 4 means that even if two web documentations have the same functionality, they are different in the details of implementation, and means that even if two web documentations which consist of many text and links have the same functionality, they are different in the details of implementation.

So, the web documentation complexity satisfies the property 4 clearly.

Property 5. *(¢£P)(¢£Q)(|P|¡Â|P;Q| & |Q|¡Â|P;Q|)*

The property 5 is monotonic. This means that if the combined web documentation is constructed from the web documentation P and web documentation Q, the value of the web documentation complexity for the combined web documentation is larger than the value of the web documentation complexity for the web documentation P or the web documentation Q

In case of the web documentation complexity, the number of DR's node of the new combined web documentation constructed from the web documentation P and the web documentation Q is more than or equal to the number of the DR's node of the web documentation P or the web documentation Q. Even if the DR's node increases, the value of web documentation complexity may not increase. For example, assume that the reference probabilities of node N1, node N2, node N3, node N4, and node N5 in the DR graph having five nodes are 0.2. Then, the web documentation complexity of this graph is 2.322. Assume that the new node N6 is added to this graph, the weight of all arcs connected from the node N6 to all old nodes(N1, N2, N3, N4, N5) is ten. Then, the reference probabilities of node N1, node N2, node N3, node N4, and node N5 in the new DR graph having six nodes are 0.105 and the reference probabilities of node N6 in the new DR graph having six nodes are 0.475. Then, the web documentation complexity of the new DR graph is 2.217. Therefore, the web documentation complexity is not monotonic

So, the class complexity does not satisfy the property 5 clearly.

Property 6.a. *(¢¤P)(¢¤Q)(¢¤R)(|P|=|Q|&|P;R|¡Á|Q;R|)*

This property is contextual property. It means that if a new web documentation is appended to two web documentations which have the same web documentation complexity, the web documentation complexities of two new combined web documentation s are different

I assume that the new web documentation constructed from the web documentation P and the web documentation R and the new web documentation from constructed the web documentation Q and the web documentation R are generated, and the web documentation P and the web documentation Q having the same web documentation complexity have a different functionality. As the functionality of the web documentation R may be equal to the functionality of of the web documentation P and may be

different from the functionality of the web documentation Q, the web documentation complexity of two new combined web documentationes may be different each other. For example, assume that the reference probabilities of node p1, node p2, node p3, and node p4 of the DR graph at the web documentation P are 0.25, the reference probabilities of node q1, node q2, node q3, and node q4 of the DR graph at the web documentation Q are 0.25, and the reference probabilities of node r1, node r2, node r3, and node r4 of the DR graph at the web documentation R are 0.25, then the web documentation complexities of the web documentation P, Q, and R are 2. If the component p1 and the component r1 have the same functionality, and the component p2 and the component r2 have the same functionality, then the nodes of new web documentation constructed from the web documentation P and the web documentation Q are p1, p2, p3, p4, r3, r4. The reference probabilities of node p3, node p4, node r3, and node r4 are 0.125, and the reference probabilities of node p1, and node p2 are 0.25. Therefore, the web documentation complexity of this web documentation is 2.5.

If the functionality between all nodes of web documentation Q and all nodes of web documentation R is different, then the nodes of new web documentation constructed from the web documentation q and the web documentation R are q1, q2, q3, q4, r1, r2, r3, r4. The reference probabilities of node q1, node q2, node q3, node q4, node r1, node r2 node r3, and node r4 are 0.125. Therefore, the web documentation complexity of this web documentation is 3. So, the web documentation complexity satisfies the property 6.a clearly.

Property 6.b. *(¢□P)(¢□Q)(¢□R)(|P|=|Q| &*
|R;P| ¿Á |R;Q|)

This property is contextual property like property 6.a. The property 6.b is able to be proved like the property 6.a. So, the complexities defined in this paper satisfies the property 6.b.

Property 7. *The permutation of links within the* web documentations *being measured can change the metric value.*

In case of the web documentation complexity, changing the order in which link in the web documentation are declared does not affect the order in which they are executed. So, the web documentation complexity does not satisfy this property.

Property 8. if P is renaming of Q, then *|P| = |Q|*

This property requires that when the link name in a web documentation change, the web documentation complexity should remain unchanged.

As the web documentation complexity don't depend on the names of links, they also satisfy this property.

Property 9. *(¢□P)(¢□Q)(|P| + |Q| < |P; Q|)*

The property 9 means that the web documentation complexity of a new web documentation combined from two web documentations is greater than the sum of two web documentations' web documentation complexity.

In the case of the web documentation complexity, suppose that there are web documentation P and web documentation Q, and the new web documentation is constructed by combining the web documentation p and web documentation Q. Suppose the web documentation P has four nodes, and web documentation Q has three nodes, and the reference probability of the node p1 of web documentation P is 0.7 and that of node p2, node p3, and node p4 of web documentation p is 0.1, and the reference probability of node q1, node q2 of class Q is 0.1 and that of node q3 of class Q is 0.8. Then, the web documentation complexity of web documentation P is 1.36, and the web documentation complexity of web documentation Q is 0.92, and the the sum of those is 2.28. Now suppose that we make a new web documentation K by combining from the web documentation P and web documentation Q. This new web documentation K consists of all nodes of web documentation P and web documentation Q, and the reference probability of all nodes of the new web documentation K may be same. Then, the web documentation complexity of the new web documentation K is 2.81. Therefore, the web documentation complexity of a web documentation combined from two web documentations is greater than the sum of two web documentations' class complexities. So, the web documentation complexity satisfies this property clearly. We assert that the property 9 is satisfied very easily.

At conclusion, the software complexity proposed in this paper satisfies all properties except Weyuker's property 5 and property 7.

6. Experimental Result

We measure the web documentation complexity for web documentations experimentally. We measure the web documentation complexity of 225 web documentations that are extracted from WWW. We analyze these web documentations, construct DR graphs, and measure the web documentation complexity. This result shows the Figure 2. Here, X means the number of the web documentation files, and Y mean the web documentation complexity. According to analyze the Figure 2, we assert that the more the number of the web documentation's links increase, the more web documentation complexity increase.

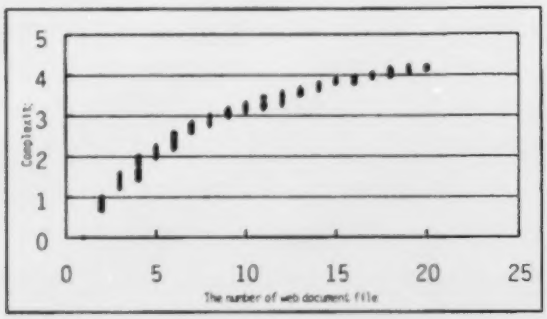

Figure 2. The Ralatioship Between Web docuemenataion and Compexity

We use the Pearson's correlation coefficient R to validate the complexities. The Pearson's correlation coefficient between two variables is a basic statistical measure used to estimate the degree of linear relationship between two variables.

In this experimental result, the Pearson's correlation coefficient R between the number of the web documentation files and the number of links in the web documentation is 0.949. This reslut is very satisfied. So, the property 5 of section 5 is not satisfied mathmatically, but satisfied experimentally.

7. Conclusion

The the web documentation complexity was proposed in this paper, is based on the concepts of the entropy. The the web documentation complexity is measured by constructing the DR graph, calculating the reference probability of all nodes, and applying these probability to the entropy function. The web documentation complexity proposed in this paper satisfies all Weyuker's properties except the property 5 and the property 7. But, the property 5 of section 5 is not satisfied mathmatically, but satisfied experimentally. Experimental results of web documentations show the effectiveness of the proposed metric.

In the future, we will gather many web documentations, analyze them, verify web documentation metric.

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Utilizing Electronic Portfolio to Demonstrate Content and Technology Competencies

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It is absolutely critical in today's technology enhanced world to be able to demonstrate your personal occupational knowledge as well as your skill in using a multitude of software and hardware applications. For educators, their ability to acquire a job may depend on how well they can demonstrate these abilities. There is no better way to exhbit your content knowledge and technology skill than through the use of Electronic Portfolios. This demonstration will focus on instructional strategies used in National Workshops to train faculty in the development and use of Electronic Portfolio as well as samples of both faculty and student products.

FRANCO - Flexible Reuse and Adaptive Navigation of COurseware

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Abstract: Reusing courseware is becoming more and more important. Instructors and/or authors must be better supported by the process of reusable courseware development. This paper describes an approach for designing and implementing reusable courseware with the FRANCO system. FRANCO (Flexible Reuse and Adaptive Navigation of COurseware) is a web-based system based on Zope (Z Object Publishing Environment) for constructing courses with different navigation models. The teaching subject is divided in education modules and designed with a logical dependency model. Courses are built through variable composition of the selected education modules accordingly to the model of logical dependency. The course sequence is derived from mapping of the navigation model to the domain model corresponding to the selected navigation type. An important characteristic of FRANCO is that courses are generated dynamically from educational modules, which are stored only once. Recreation of previous courses without storing them separately are also possible in FRANCO.

Introduction

The process of developing courseware (i.e. web-based, hypermedia courses) has similarities with the traditional software development, since the result of both processes is a software product. In order to avoid ad-hoc-developments software engineering approaches are also necessary for the courseware development (Klein, Stucky 01). The design phase is important for achieving a structured and easily maintainable and extendable educational hypertext system (Duval 95). On the other hand, because of the growing multimedia-development costs and high demand of courseware reusing courseware materials and adaptive courses are becoming more and more important. A good integration between design and implementation phases can support reusing same course materials in different courses. Most of the courseware systems today have been developed without a design phase and this results in static courses, where reusing course materials in different courses is very difficult. Even though if a courseware management system supports reusing same course materials in different courses, the instructor has always to know how these materials are in relation to each other when he is building a course sequence of them.

In this paper we concentrate on designing reusable courseware and on implementing adaptive navigation in courses and present FRANCO (Flexible Reuse and Adaptive Navigation of COurseware), a system for courseware design and *authoring in-the-large*. The navigation adaptability in FRANCO is different as in so called adaptive learning systems like Interbook (Brusilovsky, Schwarz 97), KBS (Henze, Nejdl 99), DCG (Vassileva 95). In FRANCO the navigation structure for a course is automatically derived directly from the domain model and not from mapping of domain and user model. In adaptive learning systems different courses are built which differentiate in the courseware they include. In FRANCO not only the materials of different courses are different but also the navigation type in such courses can be different.

FRANCO System

FRANCO is a web-based application based on Zope (Z Object Publishing Environment)[1]. Zope is a object-oriented web development platform. It provides clean separation of data, logic and presentation, an extensible set of built-in objects and a powerful integrated security model. The users of FRANCO are students and instructors

[1] http://www.zope.org

and/or authors of courseware. They have access on FRANCO via WWW with conventional browsers (Fig. 1). This is one of the most important benefits of FRANCO: Instructors and/or authors can have access to the course management system like students from all over the world; this can support the distributed collaborative courseware development. A Zope special user management system controls the access of the users on FRANCO. Zope offers an easy to use and powerful connection to leading database systems. An Interbase database is connected to the Zope server for saving data produced in design and implementation activities of FRANCO.

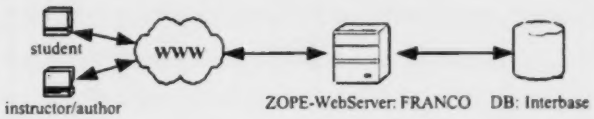

Figure 1: Architecture of FRANCO

FRANCO and The Design Phase of Courseware Development

Generally the design phase of courseware engineering consists of designing the teaching subject domain, the user interface design and the navigation design (Güell, Schwabe, Vilain 00, Klein, Stucky 01). This paper is not dealing with designing the user interface, because this activity will be supported by conventional authoring systems and is not a functionality of FRANCO.

Design of Teaching Subject – Domain Model

Dividing the teaching subject into smaller education modules enables several authors to work together on implementing courseware for the same subject and supports variable composition possibilities of these small items to different courses. Education modules are to be regarded as didactical units closed in itself. The largest difficulty of the modularity is the definition of an education module as a measurable unit. The module definition depends often on persons, projects and teaching fields (Desel, Klein, Stucky 99). Education modules can be regarded as subchapters of a book. The difference is, that the education modules (contrary to subchapters) can be used in different contexts and therefore the text flow between the education modules can not be so fluent as in books between subchapters.

General hypermedia design methodologies like HDM (Garzotto et al. 93) and RMM (Isakowitz et al. 95) consider more the structure of an application area and not the underlying content of the application. Therefore they are not well suitably for modelling didactical course contents. Special courseware modelling methods in systems like ILCE (Brok 97) and RICH (Wang 95) are using often semantic nets for modelling relationships between education modules. The most important relationship between education modules to be considered in a design phase is the dependency relationship: By learning some subject we follow a certain sequence. For the understanding of an education module it is necessary to understand other education modules. This means that there are logical dependencies between education modules, which have to be considered by their composition to courses. We can model the dependencies between education modules in the *logical dependency model.* Course compositions accordingly to the logical dependency model ensure course consistency. The logical dependency model for FRANCO is an arranged graph with edges and nodes (Fig. 2). The nodes are connected with edges. There are two types of nodes: Nodes representing education module contents and nodes representing connectors (AND and OR). The connectors have influence of selecting an edge by several incoming edges in a node. An edge from the content node n_x to n_{x+1} means that you have to learn n_x before n_{x+1}: n_{x+1} is dependent on n_x. If the predecessor node n_{x-1} of the node n_x is a connector of type OR, then it is enough that only one node from the predecessor set of n_{x-1} has to be learned before node n_x. If the predecessor node n_{x-1} of the node n_x is a connector of type AND, then it is necessary that the whole predecessor set of n_{x-1} has to be learned before the node n_x.

Figure 2: Elements of the logical dependency model

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FRANCO gives instructors and/or authors the possibility to manage the logical dependencies between the education modules. They can be put into the system with asimple HTML form. The form consists of several fields: NODE ID is unique for each node and is a capital letter representing the education module. NODE TYPE is representing the type of the node, it can be AND, OR or INH (for content nodes). NUMBER PREDECESSOR/SUCCESSOR are the number of all ingoing/outgoing edges of the actual node. PREDECESSOR/SUCCESSOR are node identifiers of the predecessor/successor nodes of the actual node. This form has to be filled for each predecessor and for each successor of a node in the tree. The dependencies are saved in the database and can be changed or removed at any time. Extending the logical dependency model will affect not only the new node, but also the existing nodes. Therefore the user has to update the existing nodes in FRANCO, if necessary. This will be supported by an HTML form in FRANCO too. The instructor can view the table for the whole model tree and can update or delete nodes (Fig. 3).

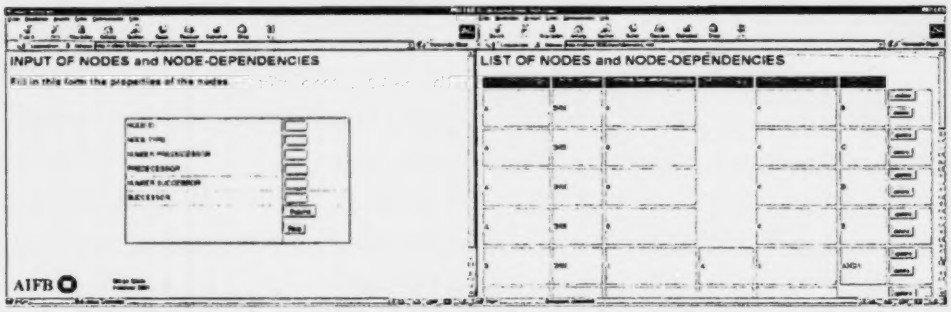

Figure 3: Managing logical dependency model in FRANCO

Navigation Design

The education modules of an hypermedia course are physically connected by hyperlinks. We different iate basically between associative (i.e. links of a semantic relationship) and organizational hyperlinks (i.e. links of a hierarchical organization) (Kuhlen 91). FRANCO generates organizational hyperlinks between education modules dynamically. That means, that the courses are not consisting of fixed linked education modules; it is possible to create different courses by reusing the same content. The organizational hyperlinks between education modules of a course in a certain navigation model are inferred from the model of the logical dependencies. The mapping between domain model and navigation types is handled in the next chapter. The associative hyperlinks for each education module are implemented in the *authoring in-the-small* phase and they can be internal associative (i.e. hyperlinks between and within education modules) and external (i.e. hyperlinks between education modules and external sources). Naturally, by uploading the educational module contents in the FRANCO system their associative links are preserved.

We can generate courses in three different navigation models within FRANCO: Linear navigation pure sequence (guided tour), linear navigation with side trips and explorative navigation (Powell 98). In a course with linear navigation pure sequence students can only navigate between education modules, which are selected by the instructor. Students don't have any other possibility to leave the guided tour, except that they can pursuit the associative hyperlinks. In a course with the softer form of sequence navigation linear navigation with side trips students can see both the selected modules and the remaining, unselected modules in the domain model. The sequence path is likewise characterized as in the form of pure sequence. The visiting possibility of unselected education modules is made noticeably to students by layout changes. It is optically clear for the students, if they are still in the guided tour or they are outside of the selected sequence. If they leave the guided tour for a side trip they can always come back with clicking one button to the position in the guided tour, where they were before. The last type of navigation is explorative navigation, whereby students determine the sequence of course sequence by themselves. Of course the system can be extended by other navigation types. It has to be noticed, that a new navigation type has to be mapped to the domain model, in order to present courses in this navigation model.

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FRANCO and The Implementation Phase of Courseware Development

The implementation of courseware is based on a bottom-up approach, i.e. it begins with the creation of smallest items and afterwards constructing larger items by their composition (Klein, Stucky 01). In the first activity *authoring in-the-small* the multimedia units (discrete and continuous media such as audio, video, animation, simulation, diagram) and afterwards hypermedia units (hypertext plus multimedia) are created. The associative hyperlinks between and within the education modules are implemented. Subsequently in the activity *authoring in-the-large* the hypermedia units are assembled and combined with a navigation type for the presentation (Klein, Stucky 01).

Authoring Support

FRANCO supports authoring in-the-large in the following points:

- it enables instructors and/or authors uploading education module contents in HTML-format, which can have been developed by several authoring systems (in this case one education module corresponds to one HTML page).
- it enables instructors and/or authors selecting education modules for a course.
- it defines the course sequence for the selected education modules (FRANCO controls the consistency of the course too: If the predecessor education module for a selected module is not in the selection list, a warning message indicating which modules are missing, will be shown.).
- it enables instructors and/or authors selecting the navigation type for a course .
- it generates a course consisting of the selected education modules and in the selected navigation type.
- it generates on-the-fly different courses (different content and/or different navigation type) reusing same education modules .
- it enables instructors and/or authors to view courses, which they built in the past (i.e. each course with selected education modules and navigation form can be recreated).

Below the welcome page of FRANCO with several authoring possibilities and the selection page of education modules and navigation are presented (Fig. 4).

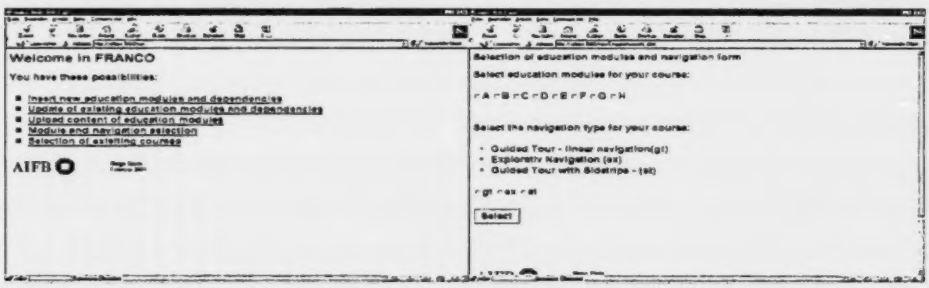
Welcome in FRANCO
You have these possibilities:
Insert new education modules and dependencies
Update of existing education modules and dependencies
Upload content of education modules
Module and navigation selection
Selection of existing courses
AIFB
Selection of education modules and navigation form
Select education modules for your course:
Select the navigation type for your course:
Guided Tour - linear navigation(gt)
Exploratiy Navigation (ex)
Guided Tour with Sidetrips - (st)
Select

Figure 4: Authoring in-the-large activities in FRANCO

Mapping Domain Model – Navigation Model

FRANCO generates courses in different navigation models on-the-fly. The education modules are stored only once, thus information redundancy will be minimized. Depending on the selected navigation type they will be connected dynamically and get the corresponding layout, so it is possible to create different sequences for the same domain model as well as to generate different navigation types for the same course. The dependencies between education modules (edges of the logical dependency model) are assigned to organizational hyperlinks. Not every logical dependency between two nodes has to be realised physically as a hyperlink. Each navigation type has a mapping algorithm to the domain model, which defines how a dependency in the subject model will be assigned to an organizational hyperlink. On the left side of the figure below is an example of logical dependency model presented. The selected nodes are shaded and on the right side courses consisting of the

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selected nodes in three different navigation models are illustrated. Extra to the connections attained by the following mapping algorithms connections back to the education modules are presented and for each course an entry page is added (Fig. 5).

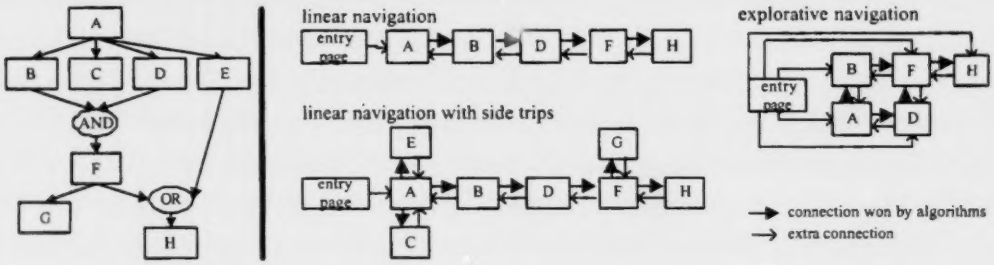

Figure 5: Mapping logical dependency model - navigation models in FRANCO

Mapping algorithm for the navigation model *linear navigation pure sequence* is as follows: All edges outgoing from a node n_x are checked. This process will be repeated until the last node of the tree is reached. All nodes added to the course sequence are marked, in order to avoid double entries. If the node n_x has only one successor (if n_x has one outgoing edge), then the sequence will look like $n_x \rightarrow n_{x+1}$. If n_x has more than one successor (if n_x has m outgoing edges), then the course sequence will look like $n_x \rightarrow n_{x+1} \rightarrow n_{x+2} \rightarrow n_{x+n} \rightarrow \ldots\ldots \rightarrow n_{x+m}$. It means, that all successor nodes of a node are placed successively in the guided tour. The sequence, in which the successor nodes are placed is not important, since they do not presuppose each other. A successor node of a node n_x can have the node type connector. An OR node means that traversing actually only one edge is sufficient, in order to add its successor node into the sequence. Thus, if the successor node is an OR, then the sequence will be $n_x \rightarrow n_{OR+1}$ (the successor node of OR). In order to avoid double entries, the OR node will be also marked though it will not be added to the course path. In contrast to OR, an AND node means, that all detailed edges must be traversed, in order to add the successor node of AND to the course sequence. Thus, if the successor node is an AND, then all predecessor nodes are noticed and it has to be waited for extending the course sequence with the successor node of AND until all predecessor nodes of AND are traversed. If all predecessor nodes of AND are marked, then the sequence will be $n_x \rightarrow n_{AND+1}$.

Mapping algorithm for the navigation model *linear navigation with side trips* is as follows: This type of navigation differs from the pure sequence, that students can also see education modules, which are not selected by the instructor. The allocation of dependencies for the selected nodes of the logical dependency model to organizational hyperlinks is exactly the same as in the pure sequence. The unselected nodes are not treated in the same manner as selected nodes, though students can see exactly, which education modules were suggested for the course and which parts of the course they can learn optionally. The mapping algorithm for the unselected nodes is as follows: It has to be set a link from a current node n_x to each unselected successor node $n_{x+1} \ldots n_{x+m}$. These links are optical different from the organizational links (Fig. 6 – the course page with side trips on the right side of the figure has an extra navigation button for unselected education modules.)

Mapping algorithm for the navigation model *explorative navigation* is as follows: : All edges outgoing from a node n_x are checked. This process will be repeated until the last node of the tree is reached. All nodes added to the course sequence are marked, in order to avoid double entries. If a node n_x has only one successor (if n_x has one outgoing edge), then the course sequence will look like $n_x \rightarrow n_{x+1}$. If n_x has more than one successor (if n_x has m outgoing edges), then the sequence will look like $n_x \rightarrow n_{x+1}$, $n_x \rightarrow n_{x+2}$, $n_x \rightarrow n_{x+3}$, ... $n_x \rightarrow n_{x+m}$. It means, that all successor nodes of a node n_x are linked to the actual node n_x. For this navigation type all connectors in the logical dependency model are ignored; it is assumed that the predecessors and successors of the connector nodes are in direct relationship to each other.

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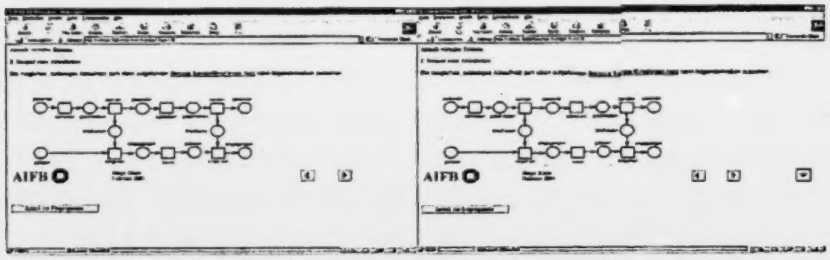

Figure 6: Course page example for linear navigation pure sequence and with side trips

Conclusion and Future Work

This paper described a concept for designing and implementing reusable courseware with the FRANCO system and intends to show that it is important to support the authoring process better. FRANCO (Flexible Reuse and Adaptive Navigation of COurseware) is a system for dynamically developing courses of education modules with different navigation models. The teaching subject is designed accordingly module dependencies and course navigation is derived from the mapping algorithm of subject and navigation model

In the near future, we intend to extend the FRANCO system with further navigation models, with a better user interface and above all with a graphical editor for logical dependency model. We plan to integrate FRANCO to authoring systems like Macromedia Dreamweaver for *authoring in-the-small* activities and extend it with communication and collaboration facilities for a better learning and distributed authoring process.

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Workflow Support for Multimedia Learning Objects

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Abstract:
Workflow services can support learning with multimedia objects in eLearning environments. to the innovation of our approach is to embed intra multimedia object navigation into the workflow. As a result, it is possible to define an overall learning workflow based on interpretation and interactions of learners and tutors with multimedia objects. A learning process can now be defined as a flow of instructions using interpretation of multimedia objects and interactivity by navigation within the multimedia learning objects.

1. Multimedia Content Management

Nowadays, when an eLearning environment makes use of multimedia objects to enhance the knowledge transfer to the learner, we talk about using new learning technologies with multimedia. (Guttormsen-Schär and Krueger 2000) give an overview of five possible definitions of multimedia as an informal explanation of what multimedia objects are:

- Medium as representation: image, movie, sound, text
- Medium as context of a representation: diagrams, text, graphs, animation, video
- Modality of communication or multisensory interaction: visual (eyes), auditory (hearing), haptic (touch), olfactory (smell), gustatory (taste)
- Static or dynamic (time varying) representations
- Physical medium for storing information: CD-ROM, hard drive, DVD formats for storing information

It is commonly accepted that using various multimedia objects in computer based eLearning environments can have many advantages compared to the traditional learning styles, e.g. face-to-face learning. However, traditional learning styles cover some (traditional) values, which computer aided learning will possibly never achieve, e.g. carrying a book wherever you go and reading it without additional tools or devices.

Still, we recognize an increasing use of multimedia objects in computer aided eLearning and therefore some questions arise such as how to cope with the growing amount of multimedia objects or how to integrate them more efficiently into the learning workflow.

The management of multimedia objects, especially digitally represented multimedia objects, can be supported by a vast amount of tools including multimedia presentation software, graphic editors, digital audio or video production systems, audio/video servers or digital broadcast systems. Multimedia Content Management Systems (Kleinberger and Müller 2000) can be used to manage large amounts of multimedia objects to facilitate the reuse by content related documentation, automatic content analysis and to support the acquisition, archiving and production workflow for distribution. These systems provide a logically centralized storage and access in multimedia repositories (Kleinberger, Schrepfer et al. 2001). The repositories comprise appropriate search and retrieval functionalities and define interfaces to other systems within the entire eLearning environment, e.g. automation systems for acquisition and broadcast, audio/video servers, newsroom systems and digital production systems. It is widely recognized, that the production and management process of multimedia objects is highly sophisticated and properly integrated in the content value chain for collection and provision of multimedia.

What we recognize as an aspect that can be improved is the usage of multimedia objects and their embedding in the usage workflow. Multimedia objects are mostly accessed as BLOBs (binary large objects) which are transferred, accessed or presented by downloading, streaming or executing in an appropriate player. They provide integrated navigation facilities like jumping along a timeline or backwards and forward playing, A common drawback, however, is that they are embedded in the learning workflow as elementary objects in a probably more or less higher instruction flow.

To overcome this shortcoming, we describe the educational workflow and multimedia objects in eLearning in a little bit more detail in the next chapters. We then define a workflow support that makes a more extensive use of multimedia learning objects.

2. Educational Workflow

Educational workflow support learners and tutors in their activity to transfer information to the learner and to let the learner learn this information, which in the end generates new knowledge. The guideline how this is processed has to be defined within the context of an overall learning strategy (such as behaviouristic, cognitivistic or constructivistic) and will be executed and controlled by instruction flow models that implement learning protocols. This is referred to as instructional design. Various methods and concepts support this workflow such as a predefined course design, cooperation tools, adaptive responses to learner requests or interaction facilities that allow learners to get in contact with other learners or tutors. The current trend is to replace the tutor more and more by a system component, which allows the learner to learn on his own. The general point to transfer information and to turn it into knowledge is nevertheless still the same.

2.1 Course design: Instruction flow

The first steps in modeling instructional design were based on behaviourist psychology, e.g. on the famous work of Skinner (Skinner 1958). This was followed in the sixties and seventies by cognitive psychology mostly leaded by Gagné. He summarized his instructional design in nine instructional events holding that by analyzing the goals of education the teachers can devise how the achievement of those goals can be met (Gagne 1965). Roger Schank goes a step further and said: „Every aspect of human behavior involves the pursuit of a(?) goal" (Schank 1993). These theories assume that one can describe a subject matter domain in terms of learning goals, and then can develop an instruction for each of the learning goals taking the optimal conditions of learning for each goal into account. This may work well for domains characterized by independent learning goals, but certainly not for developing competencies that are characterized by highly integrated, complex sets of learning goals.

From this viewpoint of constructivism processes of learning are individually and non-predictable. Thus, it is impossible to find a way to guarantee "an optimal learning process", as aimed by the "task analysis" approach. That is why constructivists are very critical about using computers in education at all; they see more chances in influences such as motivation and arousal (Holzinger 2000).

2.2 Cooperation

The L3 project (L3 stands for Live Long Learning, cf. (L3 1999)), has the objective to create a technical and organizational infrastructure for a lifelong further education. One emphasis of this project lies in the support of

cooperative learning by converging generic cooperation, integrated cooperation and method based cooperation (Wessner, Pfister et al. 1999). The solution approach emphasizes two different aspects: On the one hand the creation of an educational infrastructure which uses new media efficiently and can be used by all interested people, independently of their education or social position. On the other hand the development of organizational structured and economic business models with which the developed infrastructure can be operated in a medium term. One core component in the L3 learning environment therefore is a cooperation platform, which provides various forms of cooperative learning , e.g. chats, video conferences and e-mail, and additionally uses learning protocols as integral and didactical founded parts of learning courses. The L3 courses combine multimedia learning objects with two different types of cooperation forms: Spontaneous Points of Cooperation (SpoCs) and intentional points of cooperation (IpoCs). As a result, they enhance learning with traditional multimedia objects in that they support of cooperative educational workflow.

2.3 Adaptivity

According to (Brusilovski 1996) adaptation techniques refer to methods of providing adaptation in existing adaptive hypermedia systems (AHS). These techniques are a part of the implementation level of an AHS. Each technique can be characterized by a specific kind of knowledge representation and by a specific adaptation algorithm. Adaptive hypermedia is a new area of research and most of the adaptation techniques are still unique in the sense that each was suggested in conjunction with the development of an AHS. Some techniques were already implemented with minor variants in some earlier systems. Adaptation methods are defined as generalizations of existing adaptation techniques, and each method is based on a clear adaptation idea which can be presented at the conceptual level. Brusilovsky is giving an example, "...insert the comparison of the current concept with another concept if this other concept is already known to the user", or "...hide the links to the concepts which are not yet ready to be learned". The same conceptual method can be implemented by different techniques. At the same time, some techniques are used to implement several methods using the same knowledge representation (Brusilovski 1996).

2.4 Interactivity

Interactivity is of paramount importance for learning purposes. Usually "interaction" is social interaction and is the relationship between two or more individuals who, in a given situation, mutually adapt their behavior and actions to each other. Limited, distinct social systems and specific situations are involved, where the partners in the interaction are located in the same time and space (are close-by) also "symbolic interaction" is involved. That is, a mutual exchange and negotiation regarding meaning takes place between partners who find themselves in the same social context (Holzinger 2000).

2.5 Standard for workflow interoperability

According to (Hayes, Peyrovian et al. 2000) efforts toward defining a standard for workflow interoperability has begun in 1994 with the Workflow Reference Model from the Workflow Management Coalition (WfMC 1995). From that model other standardization efforts have been developed from e.g. OMG's joint Flow specification to the Simple Workflow Access Protocol (SWAP). The WfMC's Wf-XML focuses on a simple subset of SWAP for a first version of a standard, with the aim of future extension (Hayes, Peyrovian et al. 2000).

3. Workflow Support for Multimedia Learning Objects

There exist very advanced solutions for interactive multimedia presentations such as Quicktime, Hyper Quicktime (Ma, Lee et al. 1998) or SMIL which allow synchronization, annotations, user interactions, cross referencing objects and controlling presentations. Unfortunately, none of these solutions can combine the characteristics of multimedia objects with the needs of educational workflow support.

There also are some proposals available for general workflow architectures (cf. (WfMC 1995), jointFlow from OMG (jointFlow 2000)) or commercial products like Oracle Interoffice, IBM Flowmark or HP AdminFlow that commonly do not take care of the need to incorporate multimedia objects into the educational workflow.

So, the basic idea of a workflow support for multimedia objects in learning is to look at the segments of multimedia objects as elementary steps of an instruction flow in eLearning and to integrate interactions with multimedia

learning objects into the process definitions that make up an instruction flow in eLearning. We call this the embedding of intra multimedia object navigation into workflow process definitions for eLearning.

The segments of multimedia objects, mentioned above, represent the smallest units a multimedia object consists of. For example, in a video segments are frames, which are sequenced in a timeline, and in audio segments are audio samples defined by the scan frequency. Other examples include presentations, which consist of slides or even more detailed elements like the object presentation sequence steps a slide is build up from.

To integrate interactions with multimedia learning objects an eLearning environment has to support a bi-directional communication with the applications that interpret the multimedia learning objects. In one direction the applications have to inform a service component about events while interpreting multimedia learning objects. In the other direction a service component controls the interpretation of multimedia learning objects by the applications depending on the processing of the incoming events. The instance for processing of events is a service at the backend of the eLearning environment. It can be compared with the workflow enactment service defined by the WfMC enhanced by the possibility to process events generated by the interpretation of multimedia learning objects and the modification of interpretation of multimedia learning objects consisting of essence and metadata in a multimedia repository.

We define the following types of events for supporting multimedia learning objects in the eLearning workflow:

- Application Events: These are events generated by user applications, e.g. by pressing buttons, selecting objects or using navigation functions for multimedia objects.
- State Events: These are events generated by the repository part of a multimedia repository, where the essence and the metadata of the multimedia objects are stored (Kleinberger, Schrepfer et al. 2001) depending on the achievement of a defined metadata state in the repository, e.g. the presence or absence of a certain multimedia learning object.
- Time Events: Events generated by a common system clock or by reaching timecodes in multimedia object interpretation.
- Multimedia Object Events: These are events generated by the media server part of a multimedia repository (Kleinberger, Schrepfer et al. 2001) depending on the interpretation of the essence of multimedia learning objects, e.g. reaching a certain timecode on a timeline or passing segment borders generated by content descriptions or automatic content analysis (cf. the concept of stratified documentation in (Sarnowski and Kleinberger 2001)).

Figure 1 shows the concept of stratified documentation in conjunction with some time and multimedia object events in an example.

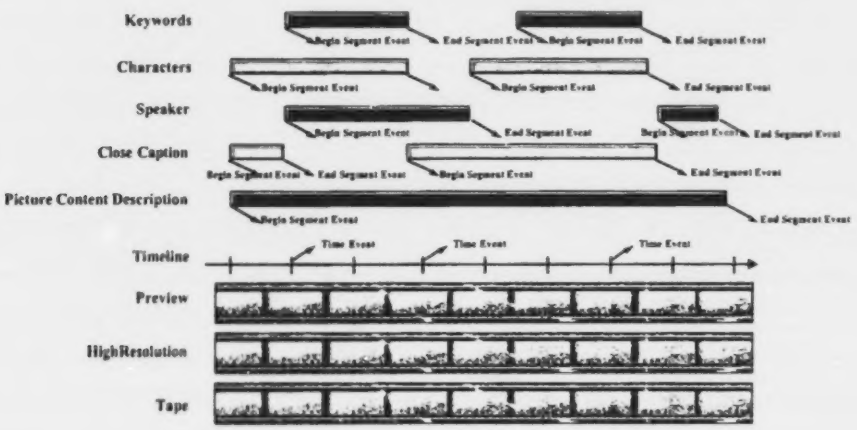

Figure 1: Stratified Documentation and Events

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A workflow component within the system design can use these events in preconditions of process definitions to trigger actions which influence interactions with the user by modifying multimedia object interpretation or simply modifying the metadata of multimedia objects in the multimedia repository. Modifying the interpretation of multimedia objects includes especially instantaneous changes of interpretation of those multimedia objects which are currently processed. These changes are carried out by the media server in the multimedia repository controlled by workflow process execution. This causes other events to be generated, which trigger other processes and so on. A simple example would be a synchronized multiple playback of a multimedia object, for example a video clip for a group of users. More advanced examples include a synchronized navigation through multimedia objects by multiple users on a segment level of a documentation stratum under consideration of individual users navigation actions, e.g. pausing, rewinding or replaying from the beginning of a segment.

As a result embedding intra multimedia object based navigation into the workflow model as elementary steps of an instruction flow allows to define learning workflows based on interpretation of multimedia objects and navigation in multimedia objects.

A very brief overview of a system design which integrates a workflow system with the components for processing application events, state events, time events and multimedia object events consists of the following main components:

- Multimedia Repository: The multimedia repository consists of a repository part, managing the metadata part of multimedia objects (e.g. LOM metadata (Holzinger, Kleinberger et al. 2001)), and the media server part responsible for managing the essences of multimedia objects (e.g. storage management and streaming of audio/video objects). The system design for this is based on the solution developed in the Live Long Learning project (L3 1999).
- Content Management System: The multimedia repository is embedded in a multimedia content management system (Kleinberger and Müller 2000), which provides the environment for acquisition, analysis, documentation, archiving, searching and retrieval of multimedia objects for an efficient reuse in production and broadcast.
- Workflow Enactment Service: The workflow enactment service consists of a workflow engine, a control data component, a process work list and a process handler which provides the runtime environment for an eLearning workflow according to the definitions of the Workflow Management Coalition.
- Workflow process definition: The workflow process definition defines the preconditions and actions of processes by rules, triggers and actions that modify data in the multimedia repository and control multimedia object interpretation through the media server and applications.
- Event Handler: The event handler collects the application, state, time and multimedia object events, matches them with the process definitions and instantiates processes that match their preconditions in the workflow engine.
- Applications: They include browsers or players, which interpret the multimedia objects, e.g. by playing back, streaming or displaying.

4. Summary

Workflow services support multimedia learning objects in eLearning environments by embedding intra multimedia object navigation into workflow process definitions. Multimedia object navigation is now integrated into learning workflow definitions. Multimedia object interpretation triggers process definitions by generating events based on stratified documentation. Processes themselves modify the interpretation of multimedia objects. This allows to define an overall learning workflow based on interpretation of multimedia objects and interactions of learners and tutors with multimedia objects by navigation.

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Building a Learning Community with Web Support

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Educators are constantly searching for new ways to engage students in the learning process. Having taught a learning community with web support twice, the authors have dealt with some of the challenges and responsibilities of teaching this type of course. This paper will examine how the course was developed. The paper will also discuss what was taught during the combined class sessions and how WebCT was used in the course. Finally, student feedback on course evaluations will be examined.

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ECO - TECH LINK

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Abstract: The ECO-TECH Link project is designed to build upon the current capacity of National University, the Natural History Museum and two high need LEA's to utilize technology in innovative ways. Specifically, the proposal will restructure the teacher preparation model by implementing an intensive 6-month pre-service teacher training program. We will enable student teachers, including women and minorities, to earn a preliminary teaching credential in six months using a combination of online, face-to-face, video and extended field experience.

Introduction

In the next decade, nearly two million new teachers will enter classrooms across the nation (Halford,1998). It is projected that by the year 2004, more than 200,000 teachers will be needed in California alone, (Time Magazine, 2000). The teacher shortage problem has been most acute in the areas of Mathematics and Science. In recent years, the California Department of Education has cited Mathematics and Science as the two critical designated teacher shortage areas. A study entitled *The Urban Teacher Challenge -Demand and Supply* reveals that virtually all of the nation's big-city school districts reported that they are in immediate need for mathematics (95 percent), and science (98 percent) teachers.

The Project

To help meet this need, National University (NU), as a pioneer and leader in online education, presently offers a variety of credential degree programs and courses via the Internet to provide exciting, interactive learning environments and access to high-quality, accredited education. As the second-largest private university in California, National offers 15 programs of pre-service teacher training using state of the art technology to reach education candidates using distance learning. The problem is that these courses are traditionally established with fixed lengths and delivered in fixed formats that take two to three years to complete. The ECO-TECH LINK project proposes to: create a new preliminary credential program that can be completed in six months; recruit individuals who are making a transition from underpaid jobs including females and minorities to obtain teaching credentials; collaborate with San Diego Natural History Museum, Cox Communications and other industry partnerships to enhance teaching and learning using interactive technology while integrating mathematics and science content; and expand the ECO-TECH LINK pilot across California and Nationally. Phase 1 will provide time for University faculty and K-12 master teachers from two large high need districts to revise methods courses to enhance the credential program and develop a program that can be completed in six months, so students can learn anytime, and anywhere in an asynchronous environment. Phase 2 will provide enhanced pre-service teaching experiences using "state of the art" interactive technologically rich learning environments with help from The San Diego Natural History Museum and Cox Communications by providing infrastructure and support for these new and innovative distance-learning experiences. Phase 3 will implement this innovative credential program by cohorts every six months beginning in December 2001, doubling and tripling the number of completed credential candidates annually. Phase 4 will expand the pre-service teacher program throughout California and nationally. Phase 5 will disseminate

standards-based products using the "Museum to School" partnership model. The San Diego Natural History Museum will provide leadership in creating these Internet-based interactive products with National University and K-12 teachers as a product for sale to provide sustainability for the project.

Recent statistics from the American Association of Colleges for Teacher Education and the Commission on Teacher Credentialing indicates that NU ranks as the number one private school that produces the most educators in California. Over 22,000 students have completed teacher programs at National University since 1984. Annually, National University places over 7,000 pre-service students in field training programs using approximately 300 districts located throughout California. However, only 2500 credentials are completed annually with the average time to complete a credential taking 2 to 3 years. This traditional timeline needs to be shortened to meet the needs of students. ECO-TECH LINK will be the first program in the country to provide a customized education model that allows students to set their own pace without being tied to conventional academic calendars. National University will offer "just in time" training to meet the growing need for credentialed teachers. The ECO-TECH LINK program will also focus on improving the quality of asynchronous distance education in partnership with the San Diego Natural History Museum, Cox Communications and two large K-12 districts.

The University has 9 regional locations throughout California and 26 learning centers, with its academic and administrative center in La Jolla, California. Each region includes a variety of academic learning centers, making education accessible to minority students located in both urban and rural areas seeking an education degree while completing student teaching at K-12 school.

Cajon Valley Union School District with an enrollment of 20,000 students. The Free and Reduced percentages range from 92.6% to 82.9% for the lowest schools in the district. Sweetwater Union High School District has an enrollment of 33,000 and is the largest 7-12 district in California. The Free and Reduced percentages range from 98% to 41%. Cajon Valley and Sweetwater have a total of 2400 teachers who will partner with National University faculty and pre-service teachers to create this new innovative program. Pre-service teachers will view digitally model lessons by master teachers in San Diego via Internet interactive technology. The technology will allow pre-service teachers many more hours of exposure and enhanced experiences in K-12 environment. Pre-service students will spend up to 8 hours a day in the K 12 schools physically and virtually. The ECO-TECH LINK model will be replicated via the Internet and a trainer of trainer model online using asynchronous technologies

One of The ECO–TECH Link's partners is the San Diego Natural History Museum. The San Diego Natural History Museum is the oldest scientific institution in Southern California. Part of the museum's scientific and educational missions are carried out by the Environmental Science Education Center, including the Museum to School Partnership program (MSP) that has been successfully run for the past two years as MSP and for five years as the "Watershed Project".

The Museum to School Partnership (MSP) helps teachers implement environmental science education programs through an integrated "watershed-based" math and science curriculum utilizing problem based teaching strategies. Using proven educational practices, teachers and administrators are trained to use a school's surroundings community as a framework to build programs that enhance students' skills, disciplinary knowledge, thinking and problem-solving skills, and basic life skills including cooperation and interpersonal communication. The MSP program will have a new "state of the art" technology rich museum that opens in April 2001. The MSP program plans to create many interactive online opportunities to access museum resources. This valuable resource will be part of the interactive collaborative curriculum to be developed by National University and Cox Communication partners.

National University has consistently taken a leadership role to improve teaching and learning by providing easy access to programs using online learning. Currently, National University's education department offers 60 courses in a distance-learning format. The ECO-TECH LINK Project will work with the Cajon Valley Union School District and Sweetwater Union High School District to design new courses for pre-service teacher that are asynchronous and consolidated. National University faculty and Master K-12 teachers will become the core of the network for the statewide and national dissemination of the program.

An analysis of the data shows a student profile as follows. (1) 34% of National University's graduates represent minority groups and 60% are females, single heads of household. (2) Most students who go to National University seek financial assistance since pre-service teachers cannot be without an income for two to three years. (3)The average student age at NU is 34, representing persons exploring second careers. (4) Most females and minority students find themselves unprepared to teach (5) Most college to work transition programs to work provides funding for less than one year, ie. military and or disability placement programs (6) Research has identified a direct correlation between teacher advanced preparation and student achievement.

National University and the ECO – TECH LINK Project are committed to make technology the centerpiece of our vision for educational reform. We are prepared to offer an 80-hour professional development session to train university faculty and master teachers using a science and math curriculum integrated with technology applications. We believe that our target audience is ready to have a "state of the art" technology delivery system to provide teacher training in a comprehensive focused manner that can be completed effectively and efficiently. Time is essential to prepare more teachers for the growing need. A unique process entitled "DesignShop" will be utilized to consolidate the planning process into a three-day event. Fundamentally, the DesignShop process is an accelerated creative problem-solving process. The DesignShop event is designed to deliver solutions, implementation plans and prototypes, in just two to three days. The intensity and synergy of the process leads successful problem solving, and to creating a cohesive grant team. National University's online programs incorporate the latest advances in technology. Students are provided with a dynamic, interactive learning environment plus access to high quality accredited education via the Internet. The evaluation component of this project utilizes a proven literacy model as the core curriculum intervention. An external evaluator Telesis Corporation will conduct the evaluation. The evaluation includes (1) longitudinal data to demonstrate student achievement and lasting growth over a five-year period; (2) University faculty, pre-service teacher candidates and master teacher input via web based activities and (3) embedded assessment in the online content activities for university faculty, pre-service teacher candidates and master teachers which will provide meaningful feedback for program modification on an ongoing basis. The evaluators' analysis of pre-service student progress as well as K-12 student progress will provide formative assessment data to show the impact of newly trained student teachers in the K-12 environment. The quality of locally developed online curricula is of utmost importance and therefore, alignment with the Western Association of Schools and Colleges (WASC), the California Program Quality Review (PQR) process and the state academic content standards ensures that the curricula can qualify as accepted courses in California.

The ECO TECH LINK project evaluation will correlate time spent by students taking an online technology based course with grades given for the class. One of the concerns has been that students taking online courses do not spend as much time "in class" as students taking classes in the classroom with a visible teacher. This study will track how long students actually spend in each of the nine online units that comprise the course. In every online course at National University, this tracking of student time in a course is termed "user activity". The online delivery system provider, eCollege, documents user activity. It is available to the instructor during the course as information to determine where students may be having difficulties. When a student logs into the course, the user activity "clock" for that individual student st arts and follows them through each unit as do the work. The evaluation data will provide evidence regarding time as a correlate to success in completion of ECO-TECH LINK courses. Semi-annually Telesis will provide a report of findings. Information will be presented to determine the overall effectiveness of the instructional and programmatic activities of the project. Annually a comprehensive report on the project will discuss the success of all cohorts as they complete the six-month program. Each goal and objective has been tied to a performance measure to ensure success of all goals and objectives. The goals listed below include specific activities to be conducted during the granting period, including data collection and evaluation components. TELESIS will ensure that all grant activities are aligned with the government performance and results act (GPRA).

Goal 1.0 National University will revise methods courses and student teaching in six-months.

Goal 2.0 National University in collaboration with strat egic partners will create asynchronous courses that use interactive "state of the art" technology.

Goal 3.0 To expand and sustain the ECO-TECH LINK partnership by institutionalizing a statewide and national effort to transform teacher education.

Goal 4.0 T o expand the population of women and minority college graduates who become fully credentialed pre-service teachers with an emphasis in science and mathematics. The evaluation of the project will include a timeline and objectives competencies to be complet ed. Data will be collected to document how the project has reduced policy barriers and implemented comprehensive online support services so that students who begin the program successfully complete the program in six months. In addition an extensive online mentoring program will be established using the two K-12 districts to demonstrate how practicing teachers can help to keep new teachers in the teaching profession.

Framework and Evaluation of HARMONY: a Collaborative Learning Environment Supported by Hand-shaking Agent

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1 Background and Objective

Currently, with the border-less spread of Internet or Intranet, computers are successively introduced into the educational fields. Computer supported collaborative learning (CSCL) is one of the focused subjects, which aim at promoting effective and efficient learning among students who are situated in physically distributed space. In such learning environment, the types of learning groups are not specified, because any students can participate into the learning group.

In the collaborative learning, especially when the students solve the exercise that has right answer and answering processes, the leader who coordinates the learning group and leads the understanding degree of group to the right answer is necessary. If such leader does not exist as the participant of group, the discussion among the learning group is not proceeded smoothly or the learning group sometimes is not able to solve the exercise. Therefore, our objective is to construct the agent called "coordinator" which monitors the discussion among the learning group and generates advices according to the situation, if necessary.

2 System Configuration

Currently, we have developed the collaborative learning environment which embeds the coordinator that generates typical advices according to the learning situation of the group[1]. In the collaborative learning, the coordinator has to generate timely and appropriate advices. Thus, it grasps the global learning situation of the group from two points of view: the progress of derived ratio and the extent of the discussion.

In order to grasp the progress of derived ratio, the resolution derivation scenario is introduced. The resolution derivation scenario represents the answering progress according to the time sequence, and consists of ordered states which correspond to individual answering scenes. Current answering scene is pointed by the indicator called "current". Each state holds the statewords which identify individual states, so "current" moves to corresponding state according to the input of statewords. In addition to "current", the system also contains indicators called "upper" and "lower", by which understanding range of group is represented. Based on relationships of these pointers, impasse situation such as no-progress of deriving answer or inappropriate learning situation such as the phenomenon in which students who cannot understand the current answering step exist is detected.

On the other hand, the extent of discussion is able to be regarded as different answering viewpoints that have been derived during the discussion. The different answering viewpoints among answering paths is defined by ratio of common and uncommon steps of them. The ratio is able to be regarded as the location of the first divergent point, because each answering step depends on the preceding answering steps, and once different answering viewpoints are adopted, the following answering steps are based on different viewpoints. For the purpose of grasping the difference among answering paths easier, the divergent tree is introduced, which arranges whole answering process into a tree structure according to the divergent points among individual answering paths. In the divergent tree, each path corresponds to the answering path and the node with child nodes is divergent point. The system calculates the different answering viewpoints based on the difference among derived answering paths, and assists the students to notice other answering paths of different viewpoints.

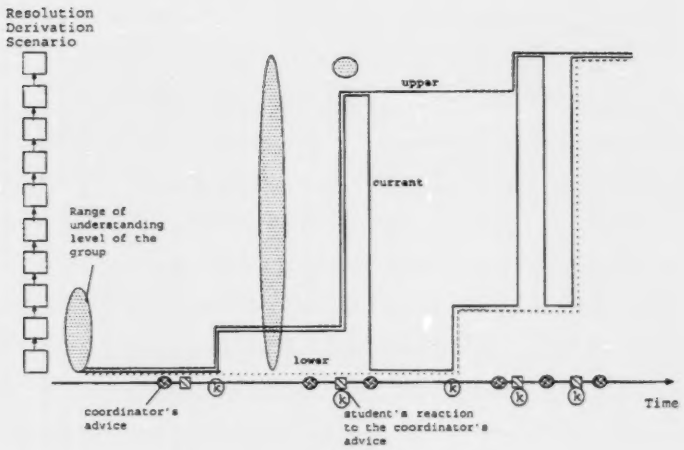

Figure 1: Experimental result

3 Experiment and Consideration

The experimental result in which 4 university students solve the mathematical exercise together is shown on Figure 1. In this figure, vertical axis corresponds to the resolution derivation scenario and horizontal axis represents the time sequence. The ovals in the figure show the changes of understanding range of the group in real world and lines are the movements of indicators. On the time axis, advices generated by the coordinator are indicated by circles and reactions of the students against the coordinator's advices are represented by squares. The circles with 'k' show the utterances that include statewords.

According to this result, the following features are highlighted.

- Students' understanding levels are not always changed by the utterances that include statewords, but sometimes by the utterances that contain only the clues of answering methods.
- For the group which consists of students whose understanding levels are high and all of whom understand the answer by ordinary discussion, the coordinator cannot grasp the understanding range of the group correctly, especially the lower level of the group, because the coordinator expects the student who does not understand discussing stage.
- The coordinator's advices have an effect on the group's discussion, since students mostly reacted to the coordinator's advices.

As a result, we can mention that the coordinator does not grasp correct learning situation, but is able to grasp the situation that students' need advices. It satisfies the coordinator's objective to lead the learning to be effective, since students are able to resolve some problems by themselves and need advices only when they cannot solve ineffective situations by themselves. In addition, based on the answers against the questions that we have asked after the learning, most students thought that the timing and the types of coordinator's advices were appropriate. Therefore, the coordinator is able to grasp the approximate learning situation and generate the advices which students regard effective.

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Considerations on User Needs for the Internet

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Abstract. This paper reports on a project on a mental health service offered on the web for young people, who have drug problems, especially with ecstasy. The service is offered by the Medical University of Luebeck and was developed in interdisciplinary co-operation between medicine, computer science and design. The focus of the project was on meeting user-specific needs: providing information and help for young people and for their peer-groups. A pre-condition for success is to design the medium according to the user needs, which means an adequate use of the medium. We provide some usage data, which reveal a need for that kind of web service.

Compared with other psychotherapeutic counseling-services which are common in the USA for several years and which increase in Europe as well, there are some main differences. The e-mail and counseling service is for free although it is provided by a professional psychotherapist. He is an expert in the subject area of ecstasy addiction and works also with young drug addicts in drug clinics. The work is based on strict confidentiality as it is given in consultations outside the web. Furthermore, the project applies technology enabling anonymous and unobservable internet use.

The authors argue that counseling on the web is a kind of communication which needs adequate technologies for anonymous transfer of data in order to protect privacy for the information seeking communication partner. However, there is a discrepancy between the requirements put forward by communication needs of users and the public discussion on prohibiting anonymity. Furthermore, from a perspective of media theory, anonymity in this context opens new perspectives on innovative use of the new medium.

1 Introduction

Since the Internet is used by an increasing number of users there is a rapid growth of information and services available. Among them there is a number of services called cyber-therapy or online-counseling, which appear in German as well (cf. Baur 1999, Eichenberg 1999). When people use these services on the web, they produce a lot of personalized and highly sensitive data. In order to protect data gathered by these Web activities of people, adequate technological concepts are needed for privacy protection of this kind of communication, which requires absolute anonymity of the person who seeks for information and services. However, on the other hand there is a current public discussion on prohibiting anonymity and unobservable use on the Internet.

What is the context of the communication we talk about? Consuming drugs influences life-styles of many youngsters. They buy party drugs or designer drugs, like ecstasy (XTC) or speed, even at the school yard. According to a report there are 30 % of the young people in the age between 16-22 years in our country, who have already tried XTC when visiting a discotheque. Traditional mental health services would fail with these people, because they do not feel in danger of drug addiction. Nevertheless, XTC-users should be well informed about the drug's risks and dangers. The Internet may offer an adequate and attractive medium for mental health services for this user group as youngsters regularly surf through the WWW and use e-mail or participate in chat rooms for communication (see recent study of German TV channels ARD and ZDF).

The basic considerations on alternative use of the new media result form our project, which wants to fertilize young persons' inclination to the WWW for the purpose of preventing drug use and providing help for resulting critical life situations. A Web-Site and other Internet services were established for those reasons. The information provided on this web site (www.mesh.de) ranges from chemical facts to the risks of consuming XTC (Kritzenberger/Ruhl/Herczeg 2000). The readers of the site are given hints on what to do and how to help immediately in the case of emergency. Authentic interviews with young drug addicts staying in a drug hospital for therapy were transcribed and made available to the public. A checklist and a questionnaire, designed by a professional therapist, are offered. They are motivated by the intention to help the youngsters to gain a realistic perspective on endangering addiction to drugs. The youngsters can feel free to fill in the questionnaire and return it by e-mail to the psychotherapist. Feedback (returning the commentary by e-mail) is given for free and without further obligations.

2 On Efficiency and Ethics of Psychotherapy and Counseling Services on the Web

The Web offers a new medium for those people who seek for advice. Therefore, it proved that counseling services have become well-established in America and recently developing in Europe as well. There are many offers for online-counseling on the WWW, e.g.

- http://www.loveadvice.com (Dr. Tracy Capot, who takes 49,95 Dollars per question)
- http://www.feelgoodcounseling.cm/onlinecounsel.htm (Ask Michele...)
- http://www.healthyplace.com/CCI/
- http://www.netpsych.com/holmes (offer for online counseling by the psychotherapist Leonard Holmes)
- http://www.metanoia.org
- www.counselingcafe.com/ser_info.htm

Many of these online-counseling services are offered by psychotherapists on the basis of e-mail contacts, sometimes there is additionally consultation via chat. Information seeking persons virtually meet with a psychotherapist for private counseling, or ask questions to experts concerning emotional help. Online counseling is meant as a viable alternative source of help when traditional help is not available, e.g. if someone has no access to a therapist nearby or might be nervous or embarrassed about face-to-face counseling. Of course, these offers are not intended for people who are severely depressed or in need of clinical care. However, it is meant as an affordable solution for those who are simply going through a tough time. Licensed psychologists offer personal training for life and career, assistance for moving life toward dreams and goals by starting an online consulting service. E-mail counseling works by asking questions or telling the situation wanted help for. The person in search of help can decide whether or not he or she wants to have an on-going relationship or just a one-time session.

There are some years of experiences with this kind of counseling in the USA, but less experiences in Europe. Some examples for online-counseling in Europe are mainly self-help groups, where counseling is for free. However, it is not always sure or even intended that advice is given by a professional in the respective area of interest. In some cases it is clear, that advice is given by a professional therapist or doctor, as it is the case with the following web addresses:

- www.profa.de/sextra (ProFamilia gives advice on questions concerning sexuality and pregnancy)
- http://www2.telecom.at/femwien/jugend.htm (online-counseling offered by the Austrian Society for Family Planning for Young People)
- http://www.telefonseelsorge.de/beratung/index.html (German telephone samaritans)

A new (since March 2000) mental health service in Germany is www.lifeline.de/navigagtion/index.html. Under the motto of "putting your questions to a doctor and get an answer" the web site offers e-mail contact, a chat café, tests and information on many subjects concerning psychological problems, sexuality, AIDS and so on. The users are offered a web form to fill in, where the insertion of name and personal e-mail address are optional. For taking part in the chat discussions the advice seekers can use a nick name. Lifeline strongly insists on the user's acceptance of the conditions of usage and declares that lifeline doesn't give any guarantee on correctness and accuracy of the answers given in any conversation or advice seeking dialogues. According to the way they see themselves, they offer only the technical platform for enabling communication between patients and doctors. In consequence, lifeline doesn't take over any responsibility for damage and doesn't want to pay compensation if things will go wrong. There are many other online-counseling services on the internet, see also Döring (2000) for an overview and categorization of these sites.

With some exceptions mostly information, e.g. on organizations, services or subject areas of interest, is provided at web sites. Some of the exceptions to this practice are named above. These exceptions clearly indicate the new trend for online-counseling which exists in Europe. But there is an intensive discussion on the use of media for psychotherapist's practice. The new medium discussed now is the internet. Some years ago ethical questions on audio or video recordings of psychotherapist sessions were discussed. Under the media aspect, several arguments could be put forward against the kind of online-counseling described above. Some mental health experts believe that it is an inferior method because the therapist cannot witness the patient's body language, demeanor or tone of voice. So, the quality of communication will be limited and communication can fail in predictable ways, depending upon the model or stereotypes they employ (Fiske/Taylor 1991). As more and more counseling services appear, mental health professional organizations begin to consider the impacts, as well as questions concerning ethics and efficiency of psychotherapists providing services over the WWW.

As far as professionalism is concerned, one can never be absolutely sure, if the e-mail or chat conversation partner is really a professional expert in the subject field. Furthermore, what about confidentiality? Strict confidentiality for e-mail contacts has to be guaranteed by the expert providing assistance and help, as the psychotherapist can do in our project, who is motivated by his professional background and affiliation. This is important from the point of view of data security. Above this common criteria critical questions may cause severe threat for punishment which would prevent youngsters in face-to-face communication situation from openness and honesty. In order to enhance confidentiality of the communication partner, the German professional association of psychotherapists is discussing to give a certificate for those, who should be allowed to provide online counseling and online therapy.

Liability is another aspect, which cannot easily be guaranteed with online-counseling. Communication via the internet is always in danger to be stopped at any time, whenever one of the communication partners does no longer want to proceed. On the one side this fact makes internet contact very attractive for many people. On the other side, however, there is a

disadvantage connected with this freedom. As there is no reliable basis for receiving a relevant answer right in time, e.g. in the emergency case.

In our project "Ecstasy-Online" data encoding with PGP (pretty good privacy) is the first step of severe data transfer in e-mail communication. Online-counseling needs secure methods to prevent attacks and guarantee confidentiality and anonymity of communication. Therefore, adequate methods are to be developed, evaluated and adapted. However, in none of the contacts with the psychotherapist anyone encoded the e-mail messages with pgp. We suppose this is for reasons of not providing a user-friendly interface with the pgp-software. Furthermore, we consider this observation as a hint that user's mental models (Herczeg 1994) on confidentiality differ from real technical conditions for privacy on the web.

Our next step will be to enable anonymity and unobservability for communication over the internet. As every use of internet services generates data traces, which can be recorded and combined at every step taken on the transfer path (Danz et al. 1999), it bears the danger of third parties to take a look at the content. Therefore, according to technical reasons all data transfer over the internet is of limited confidentiality in the above sense. In order to guarantee a maximum of confidentiality, technical concepts like anonymity and being unobserved during communication are suggested (WAU 1999). These concepts will be implemented for application in Ecstasy-Online in cooperation with the commissioner for data protection in Schleswig-Holstein in the project WAU (web surfing anonymous and unobservable), funded by the European Commission, where a technology for anonymity on the web based on mix-techniques (Chaum 1981) is developed.

3 Aesthetics of Online-Counseling Services for the Target Group

Aesthetics is essential in order attract the target group to use the web site. Adequacy for a Web site for youngsters means to adapt verbally, in tone of voice, and visually with graphic design. This should not be done by adult people who are always in danger to adapt to their own mental models and stereotypes of young people. Authentic and user adequate design involves young people's own experiences, their way of thinking and their attitudes towards proper life-style. The graphic design of the Web pages was done by a student of design (Muthesius Hochschule, Kiel, Germany) in order to meet people's taste and life-style.

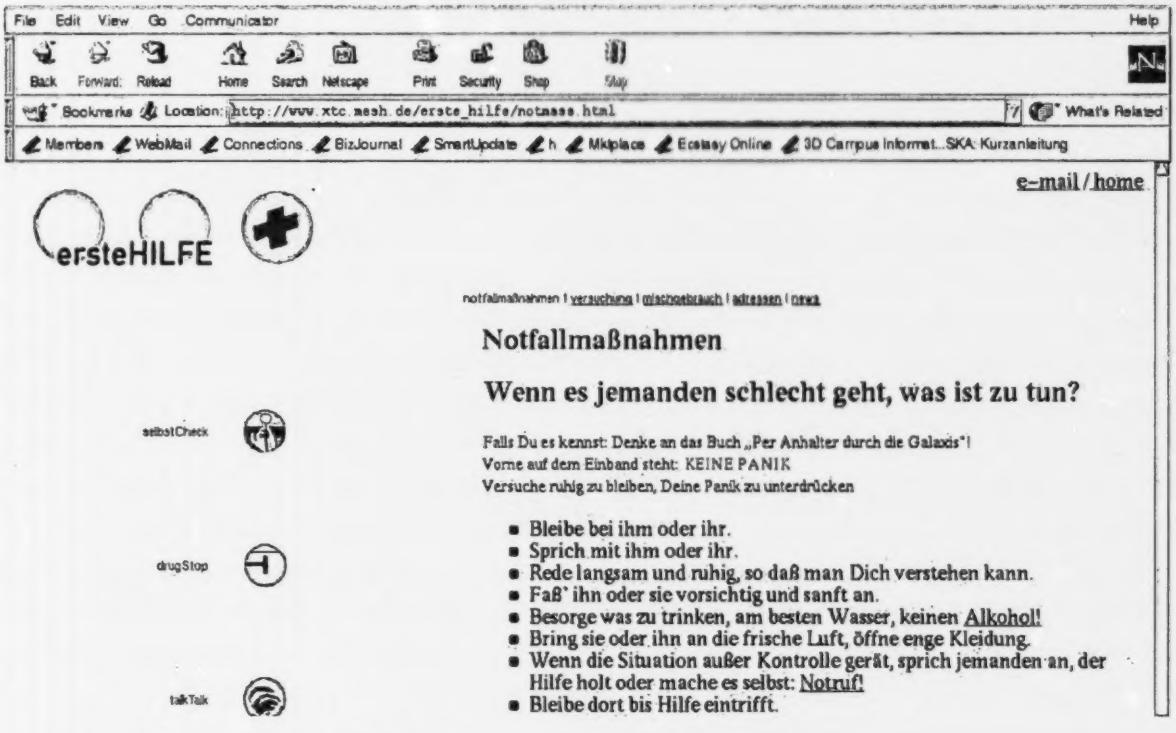
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Stop
Bookmarks Location: http://www.xtc.mesh.de/erste_hilfe/notmass.html
What's Related
Members WebMail Connections BizJournal SmartUpdate h Mkiplace Ecstasy Online 3D Campus Informat...SKA: Kurzanleitung
e-mail / home
ersteHILFE
notfallmaßnahmen | verzuchung | mißbrauch | adressen | news
Notfallmaßnahmen
Wenn es jemanden schlecht geht, was ist zu tun?
selbstCheck
Falls Du es kennst: Denke an das Buch „Per Anhalter durch die Galaxis"!
Vorne auf dem Einband steht: KEINE PANIK
Versuche ruhig zu bleiben, Deine Panik zu unterdrücken
drugStop
Bleibe bei ihm oder ihr.
Sprich mit ihm oder ihr.
Rede langsam und ruhig, so daß man Dich verstehen kann.
Faß' ihn oder sie vorsichtig und sanft an.
Besorge was zu trinken, am besten Wasser, keinen Alkohol!
Bring sie oder ihn an die frische Luft, öffne enge Kleidung.
Wenn die Situation außer Kontrolle gerät, sprich jemanden an, der Hilfe holt oder mache es selbst: Notruf!
talkTalk
Bleibe dort bis Hilfe eintrifft.

Fig 1. Screen shot from Ecstasy Online illustrating information structure

The screen shot of "Ecstasy-Online" (figure 1) shows the subject areas, for which information is provided: What to do in the case of emergency (including subjects: what to do and how to help, the effects drugs take, contact persons and so on). There is information that will help a person to estimate the degree of her or his addiction to drugs and the risk taken by this.

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The subject area called "drug stop" gives background information on drugs (chemistry), hints on literature and further information on subjects of interest. In the subject area "talk talk", communication means and interviews with drug addicted people reporting experiences in drug problems are provided. The subject area "this server" informs about the persons who are responsible for the web site, about the service itself and about privacy and anonymity on the internet and what confidentiality means in the context of "Ecstasy-Online". The subject areas are divided in a way to offer the target group quick access and a mirror of their problems and questions. In order to cope with the users' mental models and expectations there are only small chunks of information on each node, mostly short texts, in order not to bore people. The information structure is clear and concise and the important facts are marked with bullets. Besides getting information from the web site, there is a possibility for email communication with a psychotherapist.

Since more than one and a half year we have some experiences in providing mental health services to young people over the internet. In the following sections some usage data are given on information demand from Ecstasy Online. Table I shows the total number of pages requested in Ecstasy-Online from October 1999 to July 2001. In the most frequented months, March 2000, July 2000, March 2001, May 2001 and June 2001, more than 10.000 pages where requested. This clearly shows that there is a continuous interest in our service, even if it is currently restricted to the narrow subject of ecstasy use and for the clearly defined target group of those young people and their peer groups (parents, friends), who are exposed to XTC addiction or are in danger of consuming this party drug.

TABLE I

NUMBER OF REQUESTED PAGES / MONTHLY SUMMARY

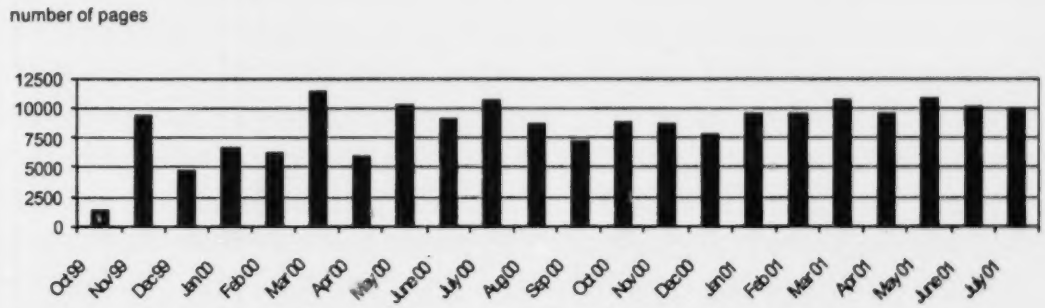
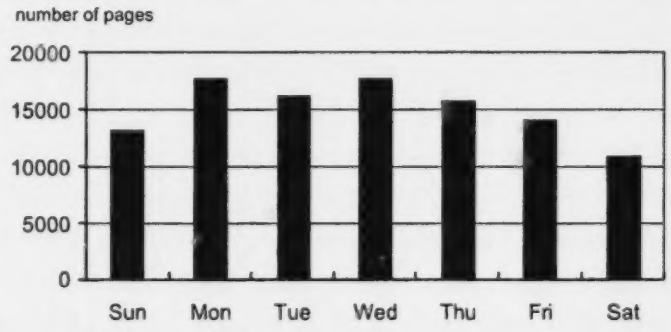


Table II shows a daily summary of the number of requested web pages in Ecstasy-Online. We see that information is demanded all over the week. Information are demanded nearly equally on week-days, less demand is during the weekend.

TABLE II

NUMBER OF REQUESTED PAGES / DAILY SUMMARY (OCT 99-JULY 01)



Similarily, the hourly summary on requested web pages, given in table III, shows that information on demand is needed. Although there a peaks in the early afternoon (1 p.m. to 3 p.m.), there is also considerable demand in the evening hours and also during the night. Therefore, this statistics as well as the statistics summarizing the weekly demand show that availability of information-on-demand seems to be an important need of this user group.

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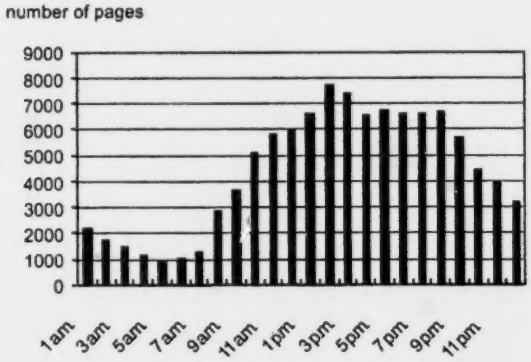
TABLE III

NUMBER OF REQUESTED PAGES / HOURLY SUMMARY (OCT 99-JULY 01)



4 On the Actual Discussion on Anonymous and Unobservable Internet Use

Online-Counseling as discussed above is one example for the citizens needs on anonymous and unobservable communication on the Internet. The subject is on discussion, since the possibility of blanket coverage of peoples' behaviors have been enlarged by the internet. In consequence the discussion on privacy protection, anonymity and unobservable use of the internet was intensified. To keep data of surfers confidential, however, is a nightmare scenario for example for customer profiling in ecommerce. Being anonymous and unobserved on the internet is intensively discussed by politicians in the context of cyber crime and therefore subject to legislation in several countries (Excerpt 2000; Schulzki-Haddouti 2000). The government of the Netherlands proposed to make the right on confidence in communication part of civil rights (Van Buuren 2001).

However, the question if anonymous internet use should become a civil right or not is controversially discussed in European countries (Krempl 2000). Since last year there is also a legislation draft of the European Council against cyber crime (Registratiekamer 2001; Vorschlag 2000). This legislation initiative foresees in article 6 that all internet providers have either to delete or to make anonymous all transfer data. On the other side there is a document of the European Working Group for Collaboration of the Police which states that several delegations (from Belgium, Denmark, France, the Netherlands, Sweden and Great Britain) see this with the reservation that the Commission would prevent access to data, which could be relevant to combating crime (Statewatch 2001). Another proposal for data collection of individual internet data transfer was put forward by the USA at the G-8-Conference (Lischka 2000), defining a kind of international internet police. Although this proposal was refused by "Internet Alliance" and by "Global Internet Project" it reveals international legislation's interest in stricter regulation and control for the communication and internet data transfer. According to their concept only digital signature should be allowed, but not the kind of anonymity needed for example for the kind of personal service offered in our project on XTC. However, in situations like mental health services for young people, there is absolutely no need for anyone to be able to reveal the identity of the communication partner or to get knowledge of sensitive personal data. In such cases it is obvious that freedom of communication needs adequate technology like the mix-concept which has to be implemented and cannot be negotiated among the communication partners (Pressemitteilung LD 08.11.1999).

5 Outlook

The intense discussion on anonymity seems to neglect some aspects of communication freedom of some user groups of the citizens. In the context of freedom of communication it resembles a war on civil rights. If we relate this discussion to the history of media and if we try to understand it from this larger perspective, we want to argue with McLuhan that people always try to bring new media under control with respect to their functions and applications (cf. McLuhan 1995). However, the hybrid nature of crossing media and the resulting interactions have an explosive nature and effect on society. At the same time these effects and interactions give people a chance to recognize the new medium's real structure and potential to use it more adequate to the nature of the new medium. One aspect of the Internet is the potential of collecting detailed information on the user. The degree of publicity of this kind of public life is greater than it could ever be on public places of our cities. From this

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point of view the message of the medium is a change in our communication rules, which we should severely think over. From a media theoretic point of view anonymity in our communication on the Internet, as described in the context above, offers a chance to explore the real nature of the medium. It may bring us one step closer to a real understanding of the new medium.

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Task-Model Driven Design of Adaptable Educational Hypermedia

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Abstract: Usability is widely recognized as being as important as functionality for the success of interactive computer systems. However, even where usability is considered seriously in the context of learning environments, there is no clear definition of usability criteria bringing together the important situational factors and learner characteristics. Therefore, a generic framework is introduced, which helps to structure the main dimensions of the learning process and focus on the most vital matters of learners and learning tasks. The framework allows covering all important usage aspects of the context of use of the learning environment during the design process and link this design knowledge with domain knowledge. Therefore, it supports the design team in framing, storing and communicating knowledge items.

1. Introduction

The process of lifelong learning changes the requirements and demands on usability of educational environments for different user groups and different contexts of use. Software designers have to find concepts and techniques to make software as flexible and interactive as to adapt to these altering demand levels [1]. There has been a rapid evolution of learning technologies in the past decade. This involved design innovations. Many of them are linked with instructional principles, learning theories, methods of framing the learning process or presentation principles for hypermedia. These principles and methods, even if they are at an abstract level, are valuable design knowledge.

There is a lot of design knowledge available, which covers a high potential for developing more effective, efficient and usable educational environments. Nevertheless, we lack effective methods to capture, represent, communicate and apply this knowledge. Therefore, a systematic conceptual representation of design knowledge is needed to deal with it during the design process. Furthermore, design knowledge should be available for re-use during run-time. To achieve this it is necessary to pay more attention to its nature and development and to use this knowledge to bridge the gap between the design and the usage phase. A solution seems to be a model-based approach to support the design and implementation of educational hypermedia able to adapt to different types of usage. In this context different types of users and relevant task models have to be identified. Even if the identification of these classes of design knowledge might be a problem in itself for other application domains, it is available for the learning domain.

The experience of the authors is based on two projects in the context of development of web-based course material for virtual universities. The first project is called "Virtual University of Applied Sciences" www.vfh.de (1998-2003) (funded by the German Ministry of Education and Technolgoy). It aims at establishing a location independent university with a curriculum for multimedia systems and for business engineering (Bachelor, Master). The authors are involved in the production of web-based courses, in the design of user-centered learning spaces and in the support of the design process (usability recommendations and quality management). The second project "Multimedia-Based Distance Education in Medical Computer Science" (funded by the German Ministry of Education and Technology) aims at providing a complete course of studies (offered by the Virtual University of Hagen, Germany) based on a multimedia learning environment for the specialization of students in medical computer science. The project starts from a paper-based tradition of teaching and learning, from where course material has to be enriched with multimedia components, given added value by interactivity and integrated into the cooperation platform of a virtual university.

2. Media environments for Learning

One of the problem designers have to face in projects dealing with the development of learning environments is that they have to start from a paper-based tradition of teaching and learning. Content authors write a kind of book, which has to be transferred to the web in the first stage of development. Of course the conceptual model of the author on how the book will be used by learners is another one than the conceptual model behind the use of a hypertext. Hypertext is not necessarily viewed

in a linear and hierarchical way and therefore needs added-value hypermedia functionality, especially for helping the learner to keep orientation and to explore the hyperspace. Another situation of learning will come up with the integration of time-based media (multimedia course) and also with interactivity (interactive CBT), where active involvement of the learner is necessary, e.g. when doing interactive exercises or when inserting parameters into simulation and exploring what happens. By media use there are added-value functions, which were not considered by the content author. Furthermore, the learning material will be integrated into and used within the context of a virtual university, where cooperative learning with other students, e.g. in working groups, and interactions with teachers or tutors are enabled by technology. Again this kind of cooperation and communication environment will shift focus and result in variations of use for the learning material.

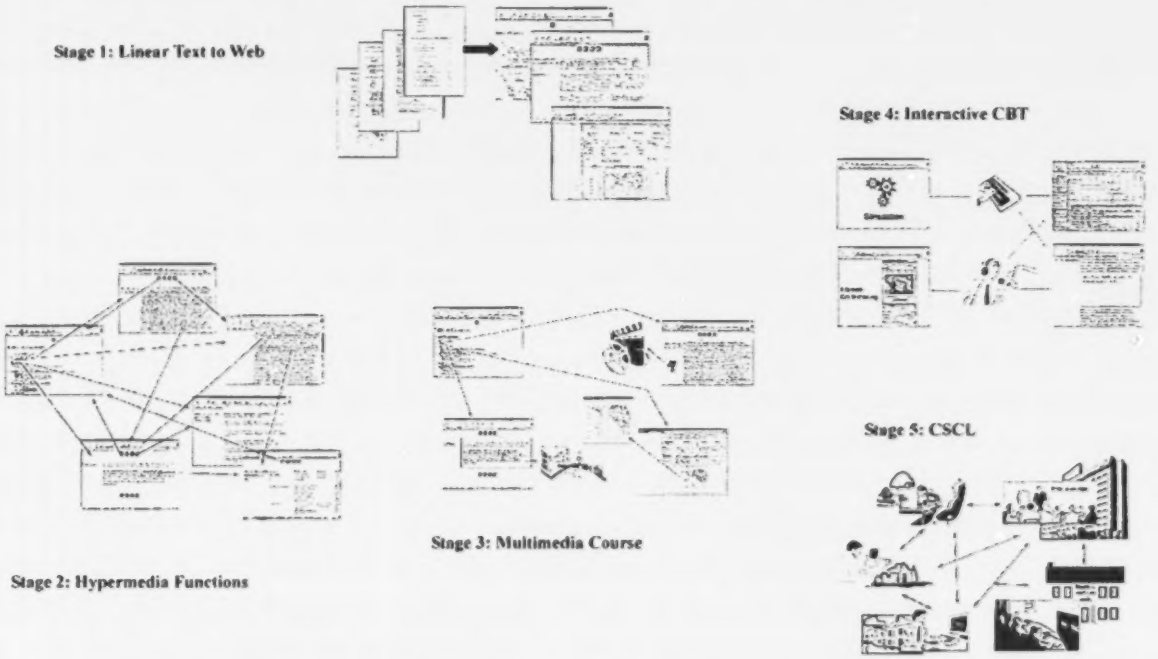

Figure 1: Different conditions of media use for Learning Environments

Normally, at each stage there are different conceptual models of the future user and of the situation of learning. Content authors normally start from writing courses as text documents that organizing knowledge in a hierarchical structure, which is are later on transferred into the associative web structure. The structuring is possibly done with authoring the hierarchical structure as guided tour into the hypertext. Although our common way of organizing knowledge hierarchically, is not the proper way for structuring hypermedia, which is centered around associations. Furthermore, the courses are enhanced with time-based media which need a careful look for example on knowledge presentation. Interactivity as a quality of action and interaction needs another pedagogic conception which go beyond models of instructional delivery of knowledge modules. Finally, in the cooperation environment, different kinds of use of the learning material can be imagined e.g. as background material for tele-teaching lessons.

Learning environments which are developed under these conditions need a media conception which considers usability. However, a user and usage-centered perspective is not easy to take, because there is a team of developers where each team member occupies a different role with different responsibilities in the design process.

3. User and Usage-Centered Design Perspective on Learning Environments

In the last years there has been a shift from user-centered to usage-centered design in the field of usability engineering. User-centered design represented a shift of focus from technology to people. To design actually usable tools, however, it is not only users who must be understood, but usage [2]. If we adopt this idea for the development of educational environments, which can be regarded as a special case of software development, this aspect seems to be rather important in itself, because the main purpose of this software is to support the task of learning in an effective way. However, as it gets clear from the

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considerations of chapter two learning environments differ according to media use. Therefore, depending on the media other kinds of learning environments with different use conditions will be developed.

In this sense, for the design of learning environments there is available a lot of design knowledge derived from learning theories and from teaching strategies, which has to be utilized for the design of learning environments. But furthermore, there are other aspects that will determine how and for what purpose the learning environment will be used. Model-based approaches seem to be promising. They aim at finding declarative models that allow designers and developers to concentrate on relevant aspects of their work without being immediately immersed in analysis and implementation details. The framework discussed in this paper and the implementation of an authoring and generation tool on this conceptual basis offers an opportunity. Besides the philosophy of how people learn there are other things to be analyzed (e.g. user needs, problems to be solved, conditions of use, resources for use, kinds of knowledge in the learning material and so on), which need to be captured, represented, communicated in the design team, as well as considered and applied as relevant design knowledge.

4. Framework for Structuring Learning Environments

The first step in the development of software is the analysis of user and task [3]. For the field of developing learning environments this means the analysis of pedagogic goals, the organizational context, and the characteristics of the intended user group (learners). If this kind of analysis is done accurately, a lot of data will be gathered. In order to be able to use these data in context, it will be necessary to store the collected data in a structured way. For this purpose pre-structuring by scenarios is a useful method. The following object-oriented framework seems appropriate for structuring, storing and applying these data in the course development process for learning environments.

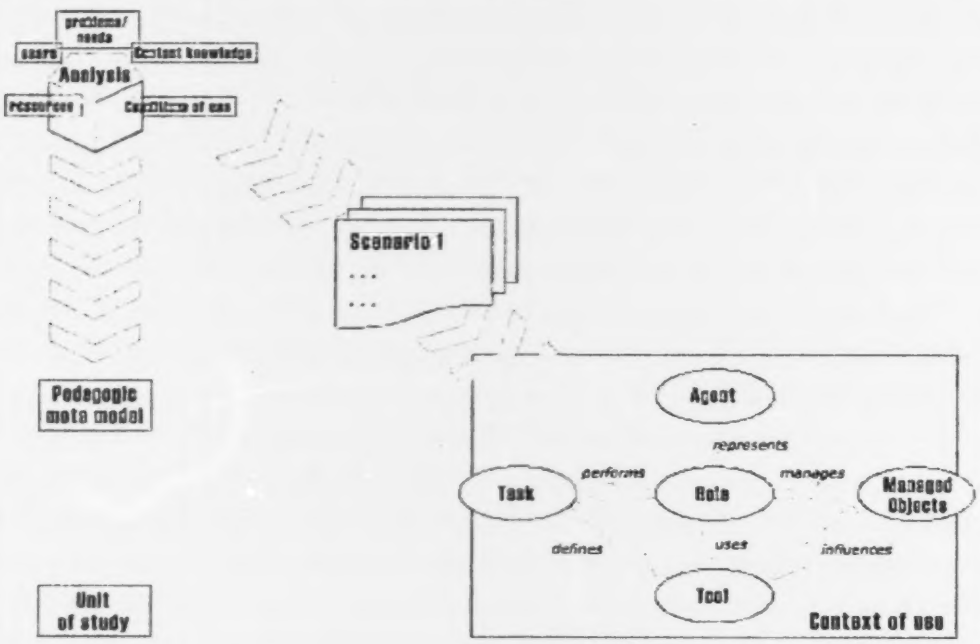

Figure 2: Analyzing and Modeling the Context of Use of Educational Hypermedia

The framework, which represents the context of use, is a generic model [4]. It proved to be useful for structuring the main dimensions of a learning environment and focus on the most vital matters of the learning process, teaching strategies, user characteristics and the conditions of use. It consists of the following application independent entities: Managed (Learning) Object, Task, Role, Agent and Tool.

Managed (Learning) Object

The idea is to store the knowledge to be taught by the course in a modular way as basic knowledge objects of a certain topic. This modularization of knowledge provides flexibility needed during run-time, when a sub-set of knowledge items is planned to be presented to the learner. The actual selection of a sub-set of knowledge items at a certain stage of use depends on the characteristics of the learner (usually defined as characteristics of a learner group). Different learner groups might be

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distinguished in this context (see role). During run-time a certain sub-set of the knowledge items will be selected and presented to the learner as knowledge sequences built from a collection of structured knowledge items of a certain topic.

Furthermore, as different learners have specific characteristics, learning objects have to be structured and presented in learner-specific ways. To specify these relations there are connections to the entity tool (as teaching strategies) and to the entity role (as user group) in order to link relevant knowledge objects.

Task

Tasks are defined by the work to be performed by the user. In the context of learning environments tasks are defined as models of the learning process. Examples for tasks at a higher level of analysis "facts", "exercises", "rules", "problem solving". On a lower level there could be more concrete task specifications like "principles for the elaboration of a sequence of knowledge items" and offer elaboration strategies for the kind of knowledge at hand. In the context of the learning environment these tasks can be understood as steps performed to complete a learning process. On a lower level of task decomposition the naming of the tasks depends on specific pedagogic models (e.g. instructional model, constructive model). But the point of view on the task as a philosophy of learning seems not to be broad enough, because the task is embedded in the context of use and is therefore modified by the specific context of use at hand. For example, different media might influence how the task can be performed and also what kind of problem the user wants to solve with using the learning environment may play a role for the exact form of the task.

Agent

The entity "agent" covers descriptions of specific target groups and intended learner groups. User groups may be diverse, if learning environments serve the purpose of lifelong learning. For example, for courses offered in the learning environment of a virtual university on the web the following learner groups may be distinguished. There may be a learner group 1, which does basic studies comparable to traditional universities or schools. There may be a learner group 2, which is interested in further education. Another learner group 3 wants training on the job and fill knowledge gaps. A learner group 4 is characterized by having a concrete problem, which has to be solved by acquiring new knowledge. In order to do so, they need to study only specific knowledge items (learning objects) or collections of knowledge items. Furthermore, a learner group 5 may want to explore the learning modules without any shortage of time. Of course, other user groups may be relevant and characterized as well. The definition of user groups is very important for the development of a learning environment, because teaching always means to address a target group with specific needs. Therefore, the means and the teaching level have to be adapted accordingly.

Role

The role specifies the context of use given by a specific learner, his or her learning tasks and the learning context, derived from the learning history. The role realizes of concrete user characteristics [5] out of the potential user groups, which are specified in the entity "agent".

Tool

The tool describes the learning environment and its user interface. This incorporates for example functionality which is sometimes called the learning space, browser and navigation tools. In a more sophisticated framework there will be different environments for specific learning tasks, situations and learner groups.

The framework allows designers and developers to concentrate on relevant aspects of their work by specifying and representing relevant design knowledge for learning environment. This design knowledge is derived from analysis of the complex real world situation (problems, user groups, conditions of use, kinds of content knowledge,) where the learning environment is needed for example as a unit of study. The complex real world environment can be modeled with the framework and the model is integrated into a pedagogic meta model for the unit of study. Compared to many other pedagogic meta models the basis of modeling is not restricted to cognitive theories of teaching and learning but covers as many relevant aspects of the situation of learning as possible.

5. Using Task Models to Adapt Hypermedia Learning Environments

The potential of learning environments adapted to learners has been put forward by studies interested in user centered design [6], [7]. The framework introduced above covers relevant aspects of user-centered as well as usage-centered design and helps to structure, represent, communicate and apply these analysis data as the context of use for the learning environment. The context of use cove:: also media aspects as discussed in chapter 2, e.g. in the specifications for the object "tool" Specification

of details within the framework is free and left to be individualized by designer needs and conceptual models on users and usage.

The task model is useful for designing more user-oriented interactions, because they will be structured according to the user's conceptual model of possible activities. Therefore, to really meet this potential of adaptation it is important to avoid inconsistencies between what has been specified in the task model and what can really be done in the implementation of the learning environment.
The framework is planned to be implemented with a relational database, XML-based data sets and a web-front-end [8]. This technical basis is capable of meeting the requirement of using design specifications (user characteristics and usage information) for the adaptation of the hypermedia learning environment during run-time. The collection of hypermedia nodes presented to the concrete learner in the web-front-end is a customized collection of knowledge objects fitting the specific user needs and usage situation at hand. The criteria for the selection and presentation of the knowledge items to the learner has to be built-in meta information (specifications on the learning tasks, on teaching strategies relevant for learner types and user groups in the entities described above, together with other relevant analysis data) and linked during the design process.

Contrasted with cognitive models of the learning process covered by many adaptive hypermedia systems [9], the framework described above is capable of covering a model of the context of use for the learning environment. The context of use model covers and represent analysis data on an adequate level of abstraction to be represented. As far as the task model is concerned for example it is not only necessary to capture cognitive states of the user compared with the domain model, as in many adaptive hypermedia systems, but other aspects also. For example, learning tasks are a sort of chain, where burden and demands alter with the change of mental states. In order to initiate successful and effective learning processes it is most important to find an adequate demand level. It causes positive mental states like happiness, motivation, increase in performance and, in the long run, even qualification and positive development of personality. On the other side, inadequate demand levels cause negative and undesirable mental states, e.g. a feeling of tiredness, drop in performance, frustration, and even psychosomatic illness. Relevant information for the adequate demand level may not only come from the users cognitive state of knowledge acquisition, but also from other aspects defined by the context of use. The kind of the problem to be solved, the kind of media environment used for it, or problems with the user interface may among others play a vital role for the definition of the demand level. Therefore, information on these aspects of the learning environment should be available as well. The framework descrived above seems to have a potential to cover such aspects and therefore it helps to cover essential information for adaptation of the learning environment.

6. Development of a Learning Environment in Distributed Teams

The implementation of the framework allows to specify all relevant information on user and usage during the design process and re-use it during run-time. It also allows distributed teams to work together during the development phase [10]. There are several reasons for it. As the implementation is web-based it can be used with a web-browser by distributed teams. Furthermore, object-oriented techniques for data-modeling allow even the handling of large data collections. Designers identify classes of information, such as "all learners", "learners of group 1", "sub-group within learner group 1" etc.. Then these classes can be freely combined into "views", which are needed by different members of the design team at different development stages. Object-oriented techniques like generalization, abstraction or inheritance are used. Attributes of the most general object are inherited by all following objects and therefore inclu[illegible]the respective view. Techniques like under-specification and refinement make the handling of large object sets easier. They allow all members of the design team to start with rough sketches of concepts and refine them during the lifecycle of the system developed. The use of a database supports the complete lifecycle of the course unit and makes all information and design rationales available for maintaining or updating the course.

7. Conclusions

The framework described above helps designers solve design problems, since the navigation through information space with unstructured and dynamic nature of multimedia data poses complex problems which have to be solved in a structured way. The object-oriented model described above allows to address different design considerations at the proper level of abstraction. The levels either concern user characteristics, learner's tasks, content knowledge or interface considerations. And as the design decisions and the reasons for the design decisions (coming from analysis) are recorded, they can be traced backward and forward in the design process. This methodology is especially helpful for team use, when for example different media considerations (see stages in the production of learning environments as described in chapter 2) are to be considered. Furthermore, it is also intended to bridge the gap between design knowledge and re-use of design knowledge in the implementation of the hypermedia learning environment. Although the implementation is ongoing, it seems to be rather promising for a task-model driven design method.

Acknowledgement

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The Design of Authoring Tools for Instruction and Content Management on the Web-Based Learning

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Abstract: In this paper we proposed a hybrid instructional model for the web-based learning. This model may consist of the following units: a lecture content description unit, an audio/video presentation unit, an Internet learning activities unit, and a course evaluation unit. To efficiently support the instructors making use of the proposed model, web-based authoring tools for instruction and content management are designed and implemented. These designed tools have many desired features: (1) allow instructor to have high degree of freedom in management their lecture presentation flow; (2) facilitate learning platform courseware management, (3) grasp the lecture structure through visual effect, and (4) equip with search and query functions. Currently, the designed tools are used to design the web-based learning courses at Tamkang University.

Keywords: Lecture content management, e-Learning, authoring tools design

Introduction

The Internet has become an important vehicle in delivering contents for learning. With suitable design, this learning environment has the potential to offer an *interactive*, *informative*, and *creative* learning environment. That has many advantages over the conventional distance learning as well as classroom teaching. Now a day, there are many academic institutes and industry partners make use of the web-based learning to deliver their distance learning and training programs. Furthermore, in November 1997, the Department of Defense (DoD) and the White House Office of Science and Technology Policy (OSTP) in USA launched the Advanced Distributed Learning (ADL) initiative (ADLnet, 2001). The initial project in the major collaborative ADL partners is to build Instructional Management Systems (IMS), which is to develop an open architecture for online learning.

There are many factors involved in establishing such an instructional management system as IMS. In this paper, we follow the similar concepts as many in the design of authoring tools (Chang-Jiun Tsai, S.S. Tseng, Ching-Tai Chen, Ho-Ling Hsu, and Jing-Ru Zheng, 2001. Sarah Horton, 2000. See-Min Kim, Shin-Chon Kang and Young-Kyun Baek, 2000. Kam W. Li, Jill Slay and Warren James, 2000.). We build an instructional model for the web-based learning (William K. Horton, 2000). This instructional model consists of four units, namely, (1) a lecture content description unit, (2) an audio/video presentation unit, (3) an Internet learning activities unit, and (4) a course evaluation unit. The purpose of this instructional model is used to guide the instructors designing the web-based online courses in an efficient and effective manner. To accomplish this goal, we also designed and implemented authoring tools for instruction and content management. As a result, these designed tools have many desired features: (1) allow instructor to have high degree of freedom in management their lecture presentation flow; (2) facilitate learning platform courseware management, (3) grasp the lecture structure through visual effect, and (4) equip with search and query functions.

The rest of this paper is organized as follows. Firstly, we present the overview of the authoring tools for instruction and management. Secondly, the description of the design of these proposed authoring tools are

followed. Thirdly, our implementation results based on MS ASP.NET technology are presented. Finally, we draw conclusions and describe our future works.

The Authoring Tools for Instruction and Content Management

The designed authoring tools consist of two main functions, namely, lecture presentation flow management and lecture section management. The web-based learning environment contains different features from the conventional classroom. For instance, learning on the web usually lacks of eye contact. As a result, it is very difficult for a learner focuses on the learning material for a long period of time. Therefore, in order to overcome this weakness, new instructional model for the web-based learning does require. In this paper, we propose a hybrid instructional model. The designed instructional model consists of the following units:

(1) A lecture content description unit
This unit describes the details of lecture content. Students may read this unit to obtain a complete picture of this lecture content.
(2) An audio/video presentation unit
Instructor prepares an audio/video summery of the corresponding lecture unit. Students may view this unit to have further impression and understanding of the lecture content.
(3) An Internet learning activities unit
This unit provides a set of the Internet learning activities, such as peer content discussion, web surfing, and related knowledge acquisition.
(4) A course evaluation unit.
This unit is used to evaluate the understanding about the lecture. The response of the evaluation can be used to improve the lecture presentation flow and content design.

This instruction model constitutes a lecture object, as shown in Figure 1. All units may not necessarily appear in the lecture object. A lecture object may consist of some of the units in any desired order. Depending on the course characteristics, an instructor is allowed to select the desired presentation flow that matches his/her individual presentation style. As a result, the model provides a high degree of freedom for instructors to design their favorite lecture presentation.

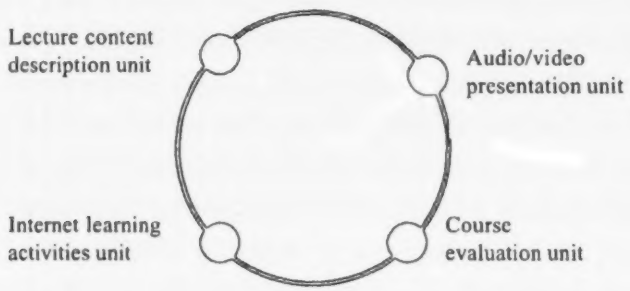

Figure 1: Hybrid instruction model

Instead of the conventional straightforward sequential presentation style, the designed lecture content management requires to match the following features: (1) lecture sharing and reuse; (2) easy to select and organize; and (3) visual effect of the contents. In the web-based learning, the lecture objects need to be organized in a more efficient manner. Thus, the instructor and the leaner are able to view the whole syllabus to obtain a complete picture of the content structure. Furthermore, the lecture object needs to be reused in different courses to increase the productivity, as shown in Figure 2. Meanwhile, from the system management viewpoint, the whole lecture objects are required to be easily accessed and managed.

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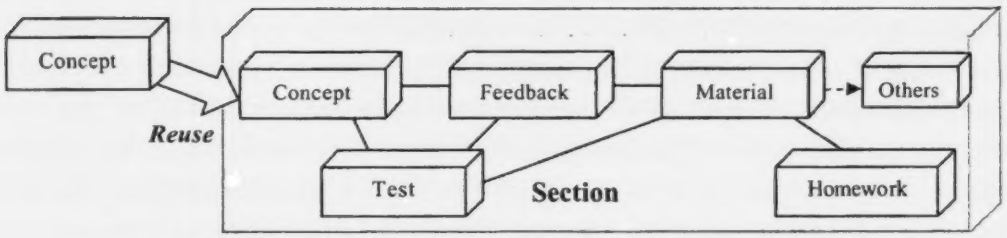

Figure 2: Different lecture object can be used in different course to construct a new section

The system architecture is shown in Figure 3. After user login, from lecture designer viewpoint, they may access the designed lecture management user interface to execute the functions such as new, edit, delete, modify, and search the lecture contents. From learners' viewpoint, they can access the platform to view the registered lectures.

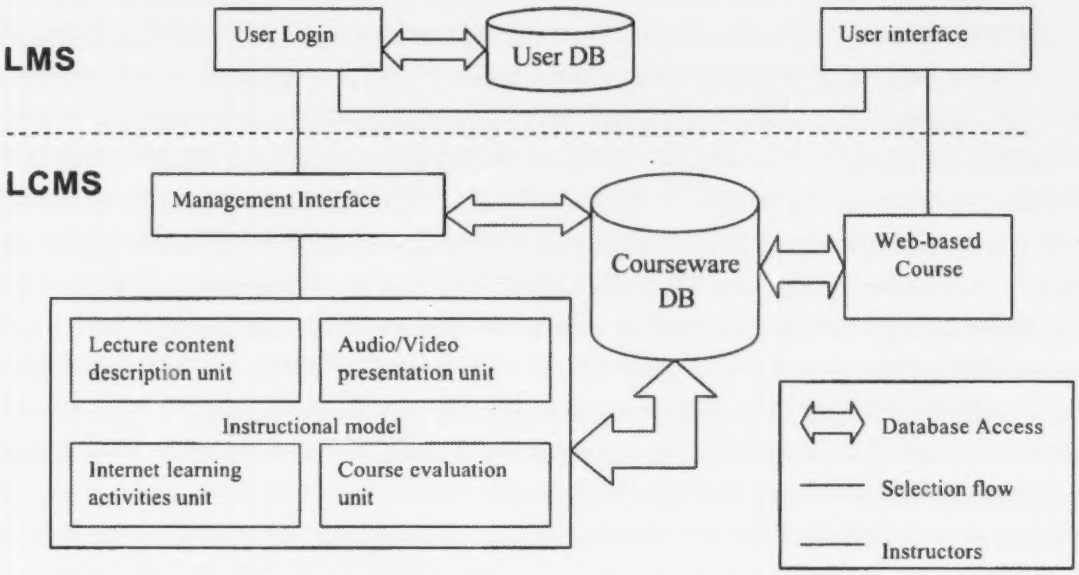

Figure 3: System architecture of the designed lecture content management system

The design of authoring tools for instruction and content management

The designed lecture authoring flow is illustrated in Figure 4. For each unit in the instructional model, lecture designer may edit new content or using the existing content in the lecture database. In the editing phase, they can arrange the presentation flow in any desired order. A preview function is also equipped. After complete the above processes, the whole lecture object is stored in courseware database as an independent lecture object.

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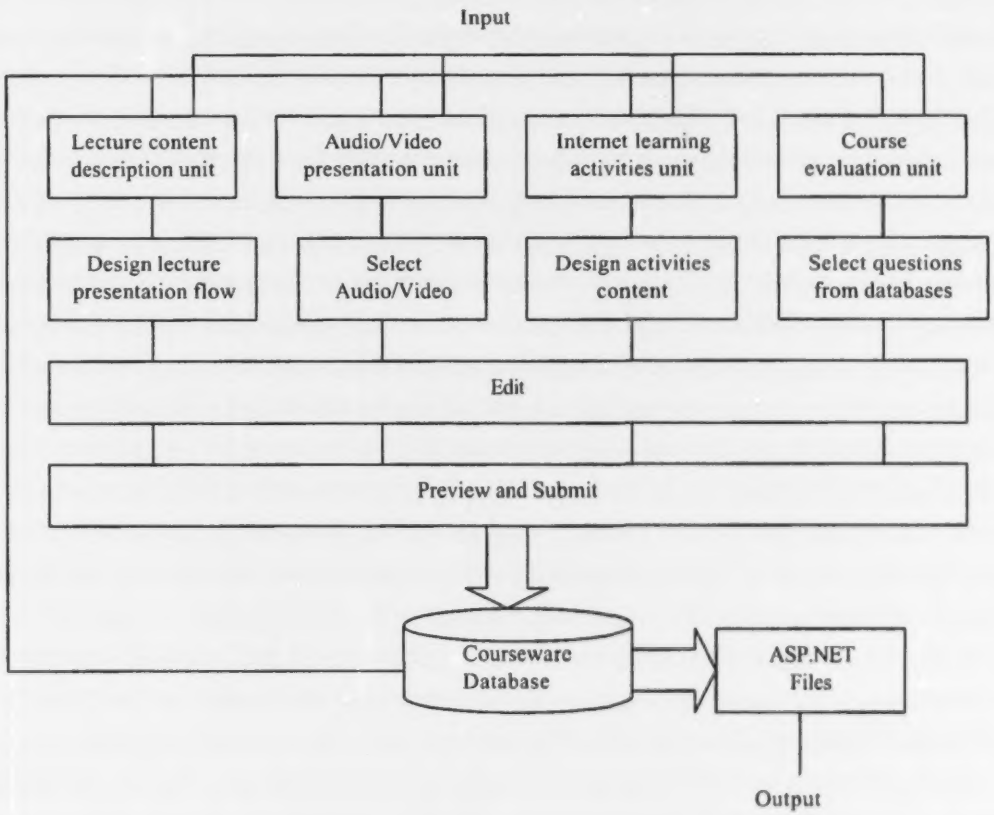

Figure 4: The lecture design flow chart

In addition to the functions mentioned before, the following features are also desired for lecture content management.

(1) Web-based authoring tool
By using the same web browser, instructors are able to design their lecture on the web by simple pull and drag functions.
(2) Creating lecture object automatically
The designed lecture objects are built automatically in system for easy access and management.
(3) Creating visual course content outline
Establish the course outline in a tree structure format for instructors and learners. Instructors are able to directly perform the functions such as delete, new, query, and modify.

To accomplish the above, we make use of the MS ASP.NET technology as our implementation development tool. The ASP.NET supports MSVB, C#, and JavaScript programming languages. It consists of desired features such as: (1) database management capability, (2) platform independent, (3) browser independent, (4) user interface and logic are separated, (5) direct access of XML files, and (6) files can be modified in the server end.

Implementation and results

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Our implementation results can be illustrated by the following screen dumps. When instructors want to new a lecture object, they enter the course management tools web page shown in Fig. 5. They able to (1) query and search contents; (2) create the content structure, and (3) display the results. In Figure 6, (4) special lecture presentation templates are provided; Users select the lecture unit from (5) and make order arrangement in (6). While the above processes are completed, we have the lecture unit outline as figure 7. The whole lecture content is illustrated in Figure 8, (9) denotes the lecture tree structure and (10) is the lecture display area.

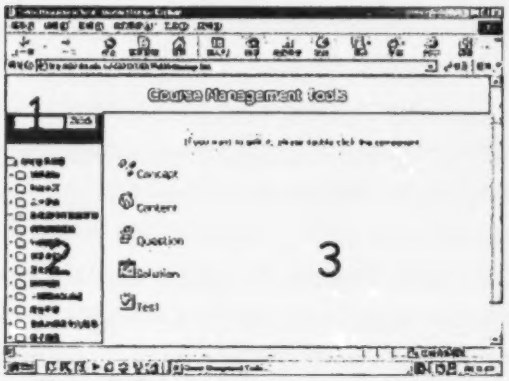

Figure 5: Courseware Management and Search

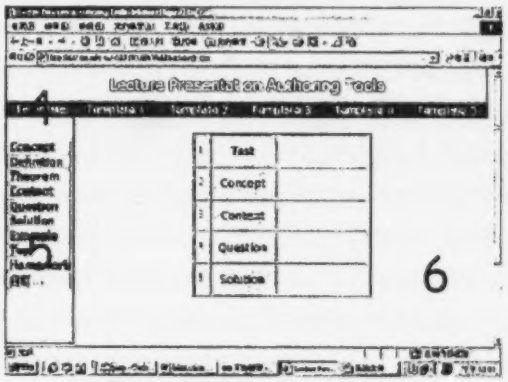

Figure 6: Lecture Presentation

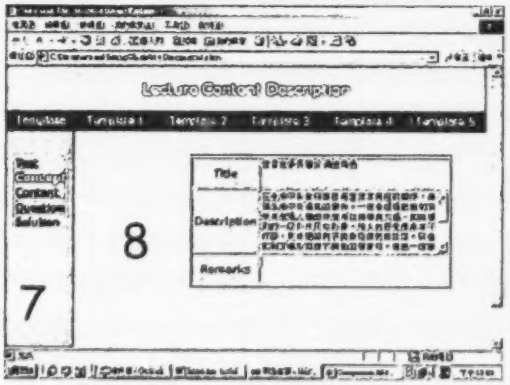

Figure 7: Lecture Content Description

Figure 8: The lecture display view .

Conclusions

Our contributions in this paper have two folds. We established an instructional model for facilitating instructors in the designing of the web-based courseware. As a result, lecture presentation flow can be easily managed as well as visualized. Furthermore, authoring tools for instruction and content management are equipped. These tools consists of the following desired advanced features: (1) allow instructor to have high degree of freedom in management their lecture presentation flow; (2) facilitate learning platform courseware management, (3) grasp the lecture structure through visual effect, and (4) equip with search and query functions.

The popularity of the Internet provides a new learning environment. Instead of transferring the instructional model in conventional classroom or imitating the existing distance learning technique to the web, as a matter of fact, how to effectively make use of this new learning environment pose changelings. It consists of many complex issues such as contents design and management, learning activities, and knowledge acquisition flow. All of these issues need to be further explored in the near future. We will pursue these issues in the design of the web-based learning.

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CyberPedia: an Internet-based Content-growing Encyclopedia and Evaluation of a Pilot Project

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Introduction

We have been developing an Internet-based, content-growing encyclopedia, called CyberPedia. This system is designed to support students studying a subject by active investigation, a method of learning in which students acquire logical thinking skills as the basis of study. This is the same as the concept of "Period for Integrated Study" that will be implemented in elementary and secondary schools in Japan, starting in April 2002. It was proposed by the Ministry of Education, Culture, Sports, Science and Technology and is designed to help children develop their ability to learn and think independently (The Curriculum Council, 1998).

We have been running a pilot project in cooperation with the Hall of Science and the Environmental Education Center of Miyagi University of Education in Sendai for all junior high school students in the city for two years. The subject they were studying was "observation of microscopic organisms." Besides videos and still images, we had also input illustrations of the internal anatomy of microorganisms, descriptions of experimental methods, and instructions on how to breed them. A huge number of pictures were uploaded to CyberPedia. The teachers were very impressed, indicating that the trial was successful. CyberPedia has also been used as a collaborative learning platform for high school education (Kakehi et al., 2001).

In this paper, we review the characteristics of CyberPedia and describe one pilot project in a Japanese elementary school and our evaluation of the project.

Characteristics of CyberPedia

The use of encyclopedia-based CD-ROMs is increasing in schools. To search for information effectively on CD-ROMs, it is important for students to know how to use the program very well and to have enough knowledge of the search topic (Zammit, 2000). On the other hand, it is difficult for teachers to keep students from taking the wrong path or wandering into subjects that deviate from the learning objective.

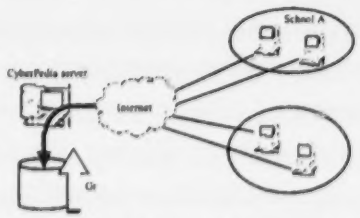

Figure 1. System configuration

In CyberPedia, the teacher starts by creating an encyclopedia concerned with a particular subject and putting contents into it, so that students can not wander into other subjects. The teacher prepares a template that includes the requirements for a research project. The students write what they studied in order, fill out the templates, and submit them to CyberPedia. All students can see what the other students input. CyberPedia is constructed on a database management system and a Web server, so they can access it via the Internet by using a Web browser (Fig. 1). CyberPedia can also handle multimedia data, such as video, still images, and sound, as well as text.

For CyberPedia, there are three types of users: managers, teachers, and students.

(1) Manager's point of view:

We developed an authoring tool so that people can easily design new encyclopedias. The manager determines the structure and design of an encyclopedia and develops it for use with a Web browser. There are three basic structures in CyberPedia: the items for retrieval, the particulars of each piece of data, and the template format. The manager can set up each one by using pop-up menus.

(2) Teacher's point of view:

The teacher can see lists of the data that students viewed and then uploaded to CyberPedia. She or he looks over the data and then decides whether to apply it or not.

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(3) Students' point of view:

Students can not only read information in CyberPedia but also upload information on what they have been studying. They can work together and add to the encyclopedia as they like. No special software is necessary to upload or retrieve information in CyberPedia. Students can do everything with a Web browser.

Pilot project using CyberPedia

A class of fourth-grade students at Higashi Rokubancho Elementary School in Sendai, Japan studied the subject of the "dynamics of water" with CyberPedia in November 1999. The CyberPedia server was set up at the school, and two students shared each personal computer.

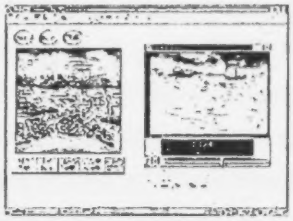

Figure 2. Swollen river video

(1) Class flow

The purpose of the river encyclopedia was for students to understand everything about a river, from its origin to the estuary where it meets the sea. Students could discover differences in the width of the river or in the landforms in various places, and so on (Fig. 2). After retrieving information from CyberPedia, they presented what they had found out and learned about rivers from each other. They considered and discussed more questions about rivers with other students, and each of them selected a specific theme to study. In fact, information on the middle section of a river was not uploaded to CyberPedia in advance. Students thus had to fill in the gaps in the encyclopedia based on their discoveries.

Next, they went to the Hirose River in their town and did a field study. They took pictures of the river with digital cameras. After that, they uploaded their findings to CyberPedia and created a river encyclopedia by themselves. They presented information on the river they had not noticed until reading other students' data, and they could thus deepen their knowledge.

(2) Results of questionnaires

We asked 29 students to fill out a questionnaire about using CyberPedia in the class. Twenty-three students felt it was "very interesting", and 5 students felt it was "interesting." There were some comments that they were surprised at the changes or impressed by the difference in a river after heavy rains. All the students were interested in uploading their results. Some students had trouble because it was their first experience typing with a keyboard, using a front-end processor, and converting to Japanese characters.

We also asked four teachers to evaluate the system. One of the teachers said the videos of rivers, especially the sound, were very important because such information could not be obtained from a textbook. They were surprised that some of the students were willing to complete the encyclopedia, and that many students approached the subject with greater motivation than in usual classes.

Finally, we asked for comments from our support staffs helping the students and teachers. Regarding the teachers' question to the class about using CyberPedia, most of the students answered that the class using CyberPedia was more interesting than a class using textbook. They were interested in uploading and browsing. Other students' ideas had a strong effect on them, so some students spoke more actively than in usual classes. CyberPedia was a nice tool for encouraging students to study with greater interest.

Conclusions

We have described CyberPedia, a pilot project using this system, and an evaluation of the pilot project. It appeared that students took much more active roles than in usual classes. As a result, we have concluded that CyberPedia is a very useful system for developing students' abilities.

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Investigating Computer Screen and Paper Reading Speed Differences

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Abstract: This paper presents the results of an experiment measuring the difference of reading speed and preference when reading on paper or screen. Extending previous experiments on the topic of reading speed measurements, which usually concentrate in specific age groups, in this experiment, forty two participants from across the adult life span took part in reading on computer screen or on paper. Results are in agreement with previous studies, which showed that reading from paper is significantly faster (around 10-30%) than reading from screen. No significant differences in terms of reading speed and preference among the three information layouts (one-column, two-column and three-column formats) used in this experiment were found.

Introduction

With the exponential increase of the use of the web for daily activities (searching for information, reading news) reading has shifted more and more from paper to screen.

Reading online occupies the majority of user time when visiting a website, triggering a large number of studies investigating factors affecting reading of electronic text. Muter and Maurutto (1991) listed a number of differences between reading from paper and screen that may account from the slower reading speeds on screen (Distance between the reading material and the reader, Angle of the reading material, Character shape, Resolution, Characters per line, Lines per page, Words per page, Inter-line spacing , Actual size of characters etc.)

Studies found that reading from papers is 20-30% faster than reading from monitors (Bailey, 1999) although Nielsen (1998) suggested that with better screen resolution (300 dpi) the reading speed from the monitor will equal the reading from paper.

Ziefle (1998) investigated the effects on reading performance using hardcopy and two resolutions of monitors, 1664x1200 pixels (120 dpi) vs. 832x600 pixels (60 dpi). Participants read from the same 19-inch monitor using black characters on light background. The subjects viewed the material from a distance of 20 inches (50 cm). In this study, reading from hard copy was reliably faster (200 words per minute versus 180 words per minute).

In terms of online information layout formats, a previous study (Lam, Lam, Liu & Shin, 2000) comparing the reading speed in reading one and three column passage found that the majority of the subjects read the three-column passage faster than the one column passage. Another study investigated user preference between one and three-column format passage and found that the subjects were significantly more satisfied with the three-column format when the passage was displayed on high-resolution screen (800 and 1000 pixels) and found no significant difference with 600 pixel screen (Andreyev & Martynov, 2000).

The present study aims to investigate the effect of information layout on the preference and reading time when the participants read passages on screen or paper. The information layouts tested are the one-column, two-column and three-column formats.

Experiment

Hypothesis

This experiment tests the following hypothesis based on the findings from previous research:

(a) Reading speed increases as the number of column increases.
(b) Users are significantly slower when reading from screen.
(c) Users prefer the three-column format compared to the one-column format.

Participants

This study expands the previous studies by balancing the age group of the participants across the adult life span. Equal number participants from three main age groups participated in the study: 14 young (18-40 years), 14 middle-aged (40-65 years) and 14 seniors (65 years and above). The means age was 50 years (S.D. = 20.44 years).

Participants were divided into two groups (those taking the reading test on the computer and those taking the test on paper). Assignment to the different treatments was random but care was taken that an equal number of participants from each age group took the experiment on screen or on paper.

Materials

The reading material was obtained from a sample ETS (Educational Testing Service) test and formatted using Hypertext Markup Language (HTML) for presentation on screen. Three different passages (discussing about three different topics) of around 160-165 words each were used. The passages have a readability scale between ten and twelve on the Flesch-Kincaid (Kincaid, Fishburne, Rogers. & Chissom, 1975) grade level score. A random ordering of the three structures (one, two, and three column treatments) was determined prior to the experiment for each participant using a Latin square design. The same pages were then printed on paper using a laser printer to be used for the paper reading experiment. A twelve-point Times New Roman font was used in presenting the text both on screen and on paper.

For the computer experiment, an IBM compatible personal computers with seventeen inch monitors (resolution 1024 X 768 pixels) were used and the text was displayed with a web browser using black characters on a light (white) background. Participants viewed the text from a 50 cm distance. Figure 1 shows an example of a document used in this experiment.

Procedure

Each participant was first presented with general instructions about the experiment and then was asked to sign the consent form. Then, they were asked to answer a short pre-questionnaire (in the case of users taking the experiment on the computer this included questions about their computer and web use, for those taking the experiment on paper it included questions related to their newspaper/magazine reading frequency).

Participants were then given time to ask clarification questions and finally they were asked to perform a total of three reading tasks. They were instructed to read the passage as fast as possible but as carefully as possible to be able to answer questions related to it after they complete reading. The participants were not told about the hypotheses tested in the study. After completing the reading of each passage, users were asked to answer three basic questions related to what they have just read.

The total time to perform each task was recorded either using an automatic time stamp on the computer or using a stop watch in the case of reading on paper.

After completing his/her last reading task, the participant was asked to record his/her preference of the display format (one, two or three column treatment) and provide a reason for his/her choice.

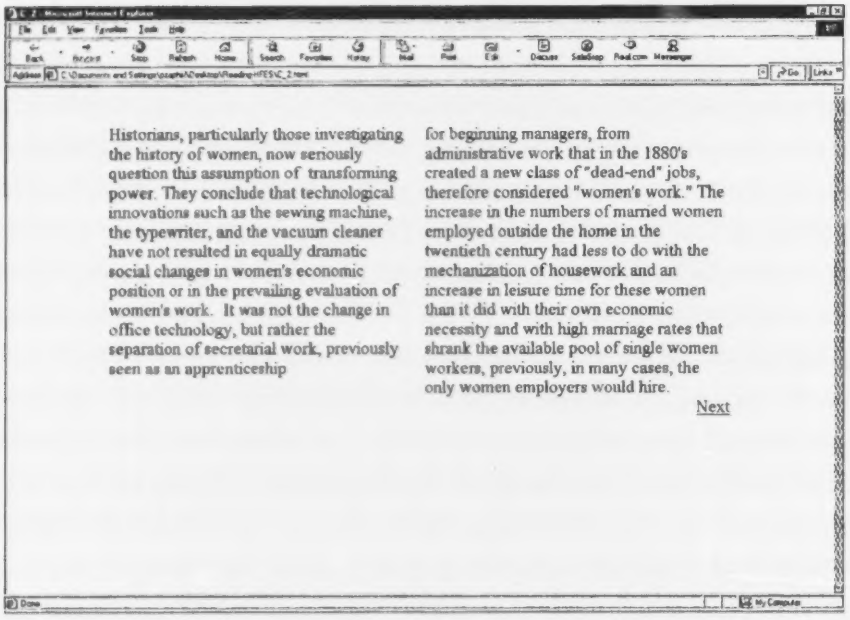
Historians, particularly those investigating the history of women, now seriously question this assumption of transforming power. They conclude that technological innovations such as the sewing machine, the typewriter, and the vacuum cleaner have not resulted in equally dramatic social changes in women's economic position or in the prevailing evaluation of women's work. It was not the change in office technology, but rather the separation of secretarial work, previously seen as an apprenticeship for beginning managers, from administrative work that in the 1880's created a new class of "dead-end" jobs, therefore considered "women's work." The increase in the numbers of married women employed outside the home in the twentieth century had less to do with the mechanization of housework and an increase in leisure time for these women than it did with their own economic necessity and with high marriage rates that shrank the available pool of single women workers, previously, in many cases, the only women employers would hire.
Next

Figure1: Screen shot of a two column text on screen

Results

Reading Speed

Table 1 shows the results of reading time (time to complete reading the text in seconds) for all formats.

	1 Column	2 Columns	3 Columns
Computer	63 (24.3)	71 (22.0)	66 (16.8)
Paper	43 (12.8)	51 (18.6)	56 (18.7)
Difference	32 %	28 %	11 %

Table 1: Reading speed (in words per minute) for column 1, 2 and 3 on screen and paper (standard deviation in parenthesis)

Although Table 1 shows that there was reading speed difference between different column formats both while reading on paper or computer screen, to test the first hypothesis, an analysis of variance (ANOVA) needs to be performed. The ANOVA analysis compared the mean reading speed for 1, 2 and 3 columns when reading on paper and on screen. No significant difference was found when reading from computer ($F(2,60) = 0.78$, $p > 0.05$) among the different column formats, nor when reading on paper ($F(2,60) = 3.02$, $p > 0.05$). Hence, Hypothesis 1 was not supported.

Visual inspection to Table 1 showed that in general the reading speed was higher when reading on paper across all column formats. However, to test the second hypothesis, another ANOVA analysis was done. Reading on paper was found to be significantly faster than reading on screen when the document is presented in a single ($F(1,40) = 10.30$, $p < 0.05$) or two column format ($F(1,40) = 10.03$, $p < 0.05$). No significant difference ($F(1,40) = 3.01$, $p > 0.05$) was found between reading on screen or on paper for text presented in a three column format. The results of this analysis are shown in Figure 1. Hence, Hypothesis 2 was partially supported.

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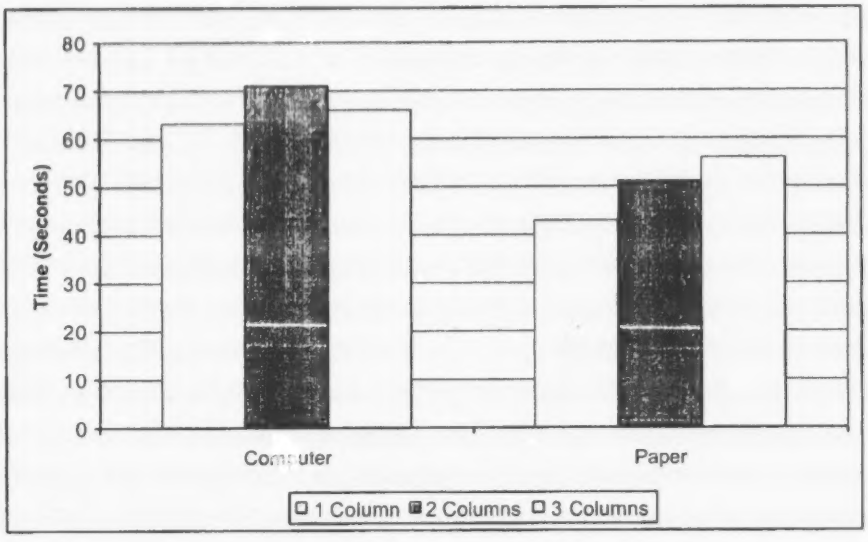

Figure 1: Average reading time results.

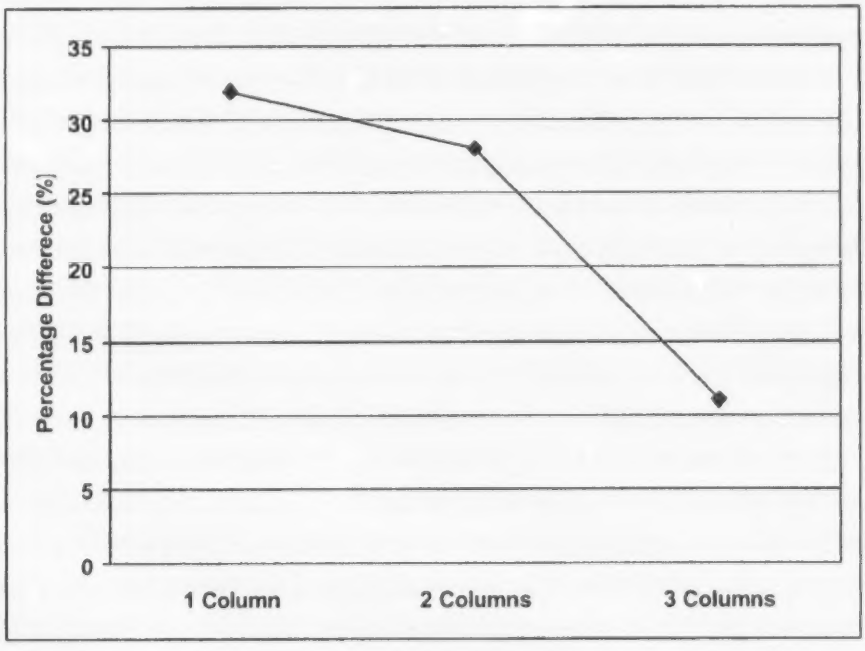

Figure 2: Percentage difference in reading from paper than from screen.

From Table 1 it can be seen that the percentage difference in reading speed diminishes as the number of columns used for displaying the information increases. A 32% difference (faster to read on paper than on screen) when the information is presented in a single column, drops to 11 % (faster to read on paper than on screen) when

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the number of columns increases to three. The results of this analysis are shown in Figure 2.

User Preference

Finally in order to test the last hypothesis, the responses of the user preferences (column 1, 2 or 3) were analyzed. No significant difference was found among user preferences ($F(1,37) = 0.11$, $p > 0.05$). Hence, Hypothesis 3 was not supported. Table 2 shows these results.

	1 Column	2 Columns	3 Columns
Computer	43%	29%	29%
Paper	33%	39%	28%

Table 2: User Preference results

Most of the participants who prefer the one-column format said that the reason was because it didn't require a lot of eye-movements, which they thought would result in disorientation (losing track where they were). Those who prefer two-column emphasized that this layout breaks the information into chunks that are more easily comprehended and it reminds them of a layout of books that they are used to. People who prefer three-column format mentioned that this format flows more easily and it chunks the information into even more highly comprehensible than the two and single column formats. Interestingly, some people wrote the reasoning about why they dislike a certain column-format rather than why they prefer a certain layout. The participants who dislike the one-column format complained that this layout required a lot of eye-movements horizontally. Similarly, those who dislike the two- and three-column formats complained about how narrow the columns were, requiring a lot of eye-movements from line to line and from one column to another.

Discussions and Conclusion

Overall, the results of this experiment are in agreement with previous studies that showed a 20-30% slower reading speeds when reading on paper than on screen.

The significant difference between reading on paper and screen for one and two column formats may be associated with users' decline of sense of orientation when reading long lines of text (single wide columns) online, most probably resulting in a bigger chance of getting lost and having to re-read the same words.

On the other hand users reading on paper were observed to use different methods to keep track of where they are in terms of reading, some used their finger to point to the words they were reading, others tended to use a pencil or a pen to guide them through their reading path. These methods were observed to be used less often when reading online (although some users did use their mouse pointer to guide them in keeping track with their reading location)

Although we expected (based on previous research) that participants would prefer text presented in three columns than on a single column, there was no significant difference in their preferences. This might be due to the familiarity of users with single column of text than two or three columnar presentation of information.

Impact for practitioners

The results of this experiment suggest that designers of online information should keep in mind that reading online is slower than on paper, and they should take steps (such as using bigger font sizes than they would otherwise put in printed materials, high contrast between text and background) to enhance reading speed online.

Suggestions for future researchers

Further research on the topic is necessary in order to identify and quantify the different parameters that Muter and Maurutto (1991) pointed out as possible reasons for differences in reading speed between paper and

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screen.

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Web Information Resources for Students with Disabilities: How Accessible are They?

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Abstract: This study is aimed at investigating whether web information resources for students with disabilities are accessible and whether there is accessibility difference between web sites from U.K., U.S., Australia and Canada as rated by Bobby automatic accessibility tool (http://www.cast.org/bobby). Thirty academic web sites from each country were tested. The analysis revealed that in general there was higher percentage of accessible web sites in this study than most of the results from other studies, but 48% of the sites were still inaccessible. The U.K. and U.S. web sites were more superior to the Canadian and Australian sites for major accessibility issues. The difference was less clear in minor accessibility issues. There was no significant difference in browser compatibility error across all originating countries.

Introduction

Internet and People with Disabilities

With more and more information and services available for public over the Internet, it is imperative that no element of society be left out. The World Health Organization estimates that seven to ten percents of the world's population are disabled, either physically or cognitively (WHO, 1999). People with disabilities are supposed to be offered unprecedented opportunities to access information and services over the Internet, because people with disabilities for the most part use the Internet in the same way everyone else does. They look for items of interest, use newsgroups, send email, purchase items, and research topics, to name a few. The difference between people with and without disabilities is that many people with disabilities face certain difficulties in using the technology needed to access the Internet. The difficulties are varied and diverse because of the wide variety of disabilities and because the issue of accessibility has not been considered as a major issue in web site design.

Fortunately, in recent years the number of sites devoted to disability issues keeps increasing. There are now sites and Internet services (such as mailing lists or chat rooms) that are devoted to specific disability issues. Ironically, in some cases these sites are inaccessible to people with disabilities (Burks et al., 2000).

Much of the base work on web accessibility (simply called the Web Content Accessibility Guidelines or WCAG) has been initiated by the international organization W3C. For the past several years W3C has researched, codified, and encouraged people to make their Web sites accessible. W3C also produced guidelines to help create accessible Web sites and continued to conduct research into how to make Web sites accessible. More and more countries have also taken the initiative to make Web sites more accessible. In the U.S. there are several federal laws related to accessibility of information technology, e.g. the Americans with Disabilities Act (http://www.usdoj.gov/crt/ada/adahom1.htm), Section 508 of the Rehabilitation Act Amendments of 1998 (http://www.ed.gov/offices/OSERS/RSA/RehabAct.html) and Section 255 of the Telecommunications Act of 1996 (http://www.fcc.gov/cib/dro/section255.html). Some sections of the Disability Discrimination Act in the United Kingdom came into force in October 1999, requiring service providers to make adjustments for people with disabilities. The Act itself has regulated the accessibility of government Web sites since 1995 (disability.gov.uk, 2000). The Australian's Disabilities Discrimination Act of 1992 has helped pave the way to making information technology more

accessible to people with disabilities. The Australian Department of Communications, Information Technology and the Art (2000) has also been quite forward in publishing material dealing with accessibility of electronic commerce and of information technology. The Government of Canada Internet Guide (1998) has an extensive chapter on building Web sites that are accessible to people with disabilities.

Internet for Students with Disabilities

Students with disabilities represent quite a significant portion of students in the world. In the calendar year of 1997-1998, 12.8% elementary and secondary students in the U.S. were disabled (National Center for Education Statistics, 1999). In the 1995-1996 survey by National Postsecondary Student Aid Study (NPSAS) of 21,000 representative sample of U.S. undergraduates, six percent stated to have disabilities (Hurst & Smerdon, 2000). In a Postsecondary Education Quick Information System (PEQIS) survey of 1998, a representative sample of two-year and four-year postsecondary institutions was asked about the enrollment of students with disabilities in 1996–1997 or 1997–1998. Seventy two percent of 5,040 U.S. institutions enrolled students with disabilities in those academic years (Hurst & Smerdon, 2000). Recent statistics show that, depending on the definition used, up to fifteen percent of Canadian students arrive at school with some kind of severe physical or mental disability (Canadian's Teacher Federation, 2000).

Realizing the importance of accommodating the students with disabilities, some countries developed some regulations related to facilitating students with disabilities. In the U.S., the Individuals with Disabilities Education Act (IDEA) were signed into law on June 4, 1997 (OSERS, 1997). The Chancellor's Office of California Community Colleges (1999) issued Distance Education Access Guidelines for Students with Disabilities to ensure that distance education in the community college system in California is accessible to people with disabilities. Texas Education Agency (2000) regulated the designs of electronic textbooks to accommodate students who are blind or vision impaired.

In the U.K., the Disability Rights Commission (2001) recently welcomed the announcement of the Special Education Needs (SEN) and Disability Rights in Education Bill and an additional £220 million to improve access for disabled students and children. The Disability Discrimination Act also contains a section on accommodating students with disabilities (disability.gov.uk, 2000):

The Act ensures recognition of the needs of disabled people wishing to study and the provision of better information for parents, pupils and students.

- *Schools will have to explain their arrangements for the admission of disabled pupils, how they will help these pupils gain access and what they will do to ensure they are treated fairly.*
- *Further and higher education institutions funded by the Further and Higher Education Funding Councils will have to publish disability statements containing information about facilities for disabled people.*
- *Local Education Authorities will have to provide information on their further education facilities for disabled people.*

Although it seems that the legal and mandates of web accessibility of information resources for students with disabilities have been well organized and set up in those countries, the practice is somewhat different. In Canada, a study of 27 colleges and universities web homepages revealed that 25 of them failed the "audit" for Web accessibility as reported by Bobby (www.cast.org/bobby), an automatic web accessibility evaluation tool (Dadson & Landon, 2000).

This study aims to extend Dadson and Landon's study (2000) in two ways

1. By analyzing more web sites (120 sites) and focusing only on web sites that contain resources and supposedly designed for students with disabilities.
2. By performing group comparisons of university web sites from four different English-speaking countries across different continents (Canada, U.S., Australia and U.K.).

This study aims to answer two research questions:

1. How accessible are academic information resources for students with disabilities are in four English-speaking countries across different continents (Canada, U.S., Australia and U.K.) as rated by Bobby?
2. Are there significant differences in accessibility measures of those four groups of web sites?

The choice of English speaking countries only in the present study was because there is a need to visually observe the content of the web sites. There are limitations of using an automatic accessibility tool in evaluating a site. Specifically, Bobby works at the code level when evaluating a web site. However, even

if the web site received Bobby's approval at the code level, if the content is outdated or written in a language not understood by some users, the site will be deemed useless. For example, in the U.S. there is a mandate that all public sites should be comprehensible by people with Grade Eight formal education. If the sites were written in more complex language, some users might not understand them. Therefore, there is a need to visually observe the contents of those sites.

Methodology

Data Collection Method

Thirty academic/education web sites from each of those four countries containing online information resources/services for students with disabilities were used in the study. The web sites were collected using keyword search of "services for students with disabilities" from http://www.google.com search engine. The web site's domain name extension (.edu, .ca, .ac.uk, and .edu.au) was used as a filter. Since Canadian university sites are not differentiable from other Canadian sites (e.g. commercial, governmental or organizational), visual observations were involved in ensuring that the web sites were academic sites.

Measures

There are eight measures from Bobby's report used in the present study:

1. *Priority 1,2 and 3 Errors* (their variable names are P1E, P2E and P3E respectively) are problems that affect the page's usability by people with disabilities at various levels, in accordance with Priority 1,2 and 3 of the WCAG.
2. *Priority 1, 2 and 3 User Checks* (P1UC, P2UC and P3UC) identify possible Priority 1,2 and 3 errors that cannot be fully automatically checked, indicating that the user will need to check them manually.

Note: if a web site passed the Priority 1 and Priority 1 User Check, it meets the Conformance Level A of the WCAG. Priority 2 corresponds to Level AA, and Priority 3 corresponds to Level AAA.

3. *The Browser Compatibility Errors* (Browser) are HTML codes that are not valid for some browsers. These errors do not necessarily cause accessibility problems, but the pages may not be rendered as expected which may impact their accessibility.
4. *Bobby's Approved* status (Approval) is symbolized with a picture of "Bobby-hat". Hats with wheelchairs indicate Priority 1 accessibility errors. Hats with a question mark identify Priority 1 User Check errors. Bobby's Approved status is equivalent to the Conformance Level A of the WCAG.

Analysis

To investigate how accessible the web sites from a particular country were, the means and standard deviations of all Bobby's measures were calculated. To investigate the accessibility differences between the sites from those four countries, their means were compared using Analysis of Variance (ANOVA) and the Least Significant Difference (LSD) post-hoc analysis when the ANOVA showed significant differences.

Results and Discussions

The descriptive statistics of the four tested categories are listed in Table 1. Visual observation showed that tested web sites from the U.K. have the highest Bobby's approval (67%) which is close to the percentage of approved sites from the U.S. (63%), followed by Australian sites and Canadian ones as the lowest one. Because Bobby's approval rating is closely related to Priority 1 ratings, the sites from the U.K.

and the U.S. were tie as the lowest at 0.37, while Canadian and Australian sites were close at 0.7 and 0.73. The separation between sites from U.K./U.S. and Canada/Australia were less clear in other ratings.

The results from Table 1 shows that across all tested countries, web sites containing information for students with disabilities are quite highly accessible (52% of the 120 web sites). Studies on web site accessibility found much lower percentage: ranging from 7.4% of 27 Canadian university sites (Dadson & Landon, 2000) to 28% of 120 U.S. health/aging web sites (Zaphiris & Kurniawan, 2001). It is not surprising that the sites tested in the study have higher accessibility since these sites were supposedly used by students with disabilities. However, it should be noted that almost half of the sites are not accessible for their prospective users, which should be viewed as a serious problem by the web designers of information resources for people with disabilities. In general, all of the accessibility measures in the present study are slightly lower than the findings from other studies (e.g. Zaphiris & Kurniawan, 2001) where the sites were not designed with people with disabilities in mind. Therefore, to answer the first research question, the evaluated web sites from these four countries are quite highly accessible compared to what other studies found.

Country		Approval	P1E	P1UC	P2E	P2UC	P3E	P3UC	Browser
U.S.	Mean	0.63	0.37	6.57	1.87	12.77	1.43	12.10	3.67
	S.D.	0.49	0.49	1.41	0.94	1.30	0.57	1.60	2.50
Canada	Mean	0.40	0.70	7.03	2.00	13.07	1.63	12.53	4.60
	S.D.	0.50	0.65	1.88	1.05	2.05	0.49	1.61	3.56
U.K.	Mean	0.67	0.37	7.47	2.40	14.17	1.73	13.00	6.03
	S.D.	0.48	0.56	1.74	1.13	1.76	0.45	1.46	5.29
Australia	Mean	0.37	0.73	7.67	2.63	14.47	1.87	13.27	5.47
	S.D.	0.49	0.64	1.47	1.30	1.74	0.51	1.68	3.86
Total	Mean	0.52	0.54	7.18	2.23	13.62	1.67	12.73	4.94
	S.D.	0.50	0.61	1.67	1.14	1.86	0.52	1.63	3.98

Table 1: Descriptive statistics of Bobby's ratings by originating countries

Across all countries, the ANOVA showed significant differences ($p<0.05$) for all of Bobby's measures except for the browser compatibility errors, and a marginal significance for the Priority 1 User Checks ($p=0.050$). The finding that there is no significant difference in browser compatibility errors suggested that there is less variation from the designers of these countries in facilitating browser compatibility. The LSD post-hoc test revealed that the mean differences were significant ($p<0.05$) for the combinations listed in Table 2.

Comparison	Significant difference
U.S. vs. Canada	Priority 1 errors
U.S. vs. U.K.	all User Checks, Priority 3 errors
U.S. vs. Australia	Bobby's approval, all Priority errors
Canada vs. U.K.	Bobby's approval, Priority 1 errors, Priority 2 User Check
Canada vs. Australia	Priority 2 errors and User Check
U.K. vs. Australia	Bobby's approval, Priority 1 errors

Table 2: Results of LSD post-hoc test

The post-hoc test' results confirm the visual observation of Bobby's approval: U.K and U.S are at the top of the chart and Canada and Australia are at the low end of the chart in terms of major accessibility issues (i.e. Bobby's Approval and Priority 1 errors). However, in some cases the difference is gradual. For example, while the difference between U.K. (which has the highest rating) and U.S. (the second) is not significant in Bobby's Approval, the difference between U.K. and Canada (the third) is significant, but the difference between U.S. and Canada is not significant.

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Interestingly, in terms of Priority 1 errors, the separation between U.K./U.S. and Canada/Australia is clearer. There is significant difference between U.K. and Canada/Australia as well as between U.S. and Canada/Australia. As mentioned above, the difference between countries in terms of other priorities or user checks are less clear. The results simply implied that the designers of the more top-tier site group focused their attention in facilitating the major accessibility issues and paid less attention in the minor issues.

Based on the descriptions in the previous two paragraphs, to answer the second research question, the web sites from U.S. and U.K. are very similar in major accessibility ratings and are more highly rated than the sites from Canada and Australia (which are also very similar in major ratings). In minor accessibility issues, the separation is less clear between those four countries.

Visual observation on the information content of the tested web sites revealed that most sites were updated and contain information of some value to students with disabilities. Another interesting observation, the top three sites from each country are usually from the highly ranked universities. These top three sites by first choosing the sites with Bobby's approved status (which also means no Priority 1 error) and the least Priority 2 error. In the case of tie, the sites with the least Priority 3 win. The winners from the U.S, for example, are web sites from Northwestern University, Harvard University and Georgia Institute of Technology. Although it may be implied that highly ranked schools put more efforts in accommodating students with disabilities, further studies to correlate university ranking with the accessibility ratings need to be done.

Conclusions

This study is aimed at investigating whether web information resources for students with disabilities are accessible and whether there is accessibility difference between web sites from U.K., U.S., Australia and Canada using an automatic accessibility tool. The analysis revealed that in general higher percentage of the web sites tested was more accessible than what other studies showed, but almost half of them were still inaccessible. The U.K. and U.S. web sites were more superior to the Canadian and Australian sites for major accessibility issues but the difference between the sites from those four countries was less clear in minor accessibility issues.

The finding of this study brought some suggestions for practitioners. The Internet is growing at a rate higher than anyone could have imagined. Everyone, including students with disabilities, uses the Internet for almost every aspect of life. If students with disabilities are not accommodated in the burgeoning world technology, they may be left behind. Accessibility does not always mean that all pages are limited to plain text. More sophisticated pages can and should also be made accessible by involving provision of alternatives to an otherwise inaccessible feature, rather than any requirement to avoid innovative design.

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One, Two, and Three-Dimensional Navigation in a Single Web Site – Learn to choose

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Abstract: After presenting a straightforward classification scheme for navigating in web based information spaces, we define One-, Two-, and Three-Dimensional Navigation as based on menus, maps and 3D environments. Our objective is to design, implement and evaluate an application, which integrates all three types of navigation and observers how users learn to navigate in complex information spaces. Thus we focus on a meta-level perspective on the e-learning process. To do so, we utilized a proprietary tool, the User Tracing, and evaluated learner navigation and interaction in a large scale pilot study. The results show the advantage of the proposed simultaneous combination and also let us identify three types of learners and navigation behaviours: "structure browsers", "3D novices", and "free floating explorers". Our findings also produced a number of new questions that we identify in the last section of this paper.

Introduction/Problem

Navigation has always been one of the key issues in web site architecture. Today, a menu-style navigation is the most widely used method: One part of the screen (one frame) is dedicated for navigation through the whole site. A tree structure (in most one to three levels deep) gives the user a structured view on all available destinations.

This navigation method is successful because it fulfils the key requirement for a navigation procedure: It works. All destinations can be reached and (almost) all users know how to use this approach. Therefore this (basically text-based) navigation is the first choice for all applications where no special effort is put on the navigation. This leads us to a more structured view on the problem space: What are the requirements for navigation methods in web applications? We will use these requirements to identify learners problems and problem solving techniques.

Requirements for web site navigation methods

Functionality: Every place in the web site must be within reach. The user must be able to see all (available) places and get there. Getting there often implies learning how to navigate. At this point it is important to point out that by "place" we do not only refer to "pages" in the conventional meaning of the word. Rather we denote individually distinguished information presentation entities. We do so because 3D environments (which we used) do not depend on a "page" structure.

Ease of Use: Navigation in most cases is not the main task a user performs on a web site. Rather, navigation is a means to reach a particular place/state in the site where the main task can be performed. Thus Navigation should never be in one's way. It must be learned easy and intuitively to use. Ease of use should not be confused with maximum performance. But an easy to use navigation interface often results in fast navigation

Aesthetical aspects: Even though navigation is in most cases not the core-task, the navigation interface needs to be visible/available at all times. This means that it should be integrated in the overall application and still be recognizable as a navigation tool. The question arises whether navigation could be an integral part of the application with no separate interface. Especially in spatial interfaces, navigation seems to be an integrated and thus invisible part of the interface. We will return to this aspect later.

Context appropriateness: Navigation always is part of a (web) application, e.g. an e-learning application. This application in turn serves a particular purpose and is therefore designed according to requirements defined externally. These design requirements include functional as well as visual aspects. E.g. a professional web site makes use of corporate design rules. In many cases, corporate design also includes certain rules for online presentations and the according navigation, e.g. "the navigation bar has to be on the right side". This can create problems if one tries to implement a navigation scheme with no navigation bar at all.

Overview at any given time: When you navigate in a (more or less) complex environment, first of all you want to now where to go; in addition you want to know where you are (orientation). This gives you the chance to change your goal or return to your origin. In addition one should not underestimate the psychological aspect of knowing where you are.

Fun: Navigation is action; therefore navigation can be fun. The role of fun in navigation and learning tasks may differ from context to context but in particular in educational applications and also in experience-oriented applications, navigation definitely should be fun. Occasional people tend to spend longer in areas where they

have fun. This contradicts the demand for performance (see below). However there is clear evidence that a funny interface does not necessarily limit performance.

Performance: Performance is always a key issue. Everybody wants to get to his/her targets fast. If you measure performance only by recording the time one needs to reach point B from point A, you may underestimate the factor of context switching and mental load: Navigating requires to stop/interrupt a currently performed task and to start/resume an other task after the change of location (i.e. after the navigation task). By mental load we mean the cognitive work needed for the navigation: If you have to analyse a complex map first and then click on your target to get there instantly, this may be a very fast way to navigate. But you really need to concentrate and thus may take some extra time to get your brain back to the task-oriented state (see also [4] and [6]). Obviously, performance relies on ease of use.

Standards: As mentioned above, menu bar navigation today is the most widely used style of navigation. Even though it is scientifically proven that other navigation styles (e.g. pie-menu-navigation [1]) are more effective for certain tasks, conventional menu bars are still ruling. This requirement is also related to the context-requirement (corporate design).

1-2-3-dimensional navigation, definition of terms

Now we have a rough overview over the requirements for a good navigation in web sites /web applications. The present section briefly discusses three navigation mechanisms based on a one- two and three-dimensional view on the problem space. We are aware of the fact that this is not the only way to structure navigation paradigms, however, in this paper we concentrate on this particular aspect.

We refer to one-dimensional navigation when we talk about traditional menu-style navigation: The user can only "move" in one dimension up or down the tree structure. Since the downward navigation allows in most cases more than one choice the term "one-dimensional" may not be adequate if you apply very strict standards. However, in this paper we consider bar menu style navigation the least variable method and thus differentiate it from the others as being "one-dimensional".

Two-dimensional navigation in this paper is defined as plane based where in most cases the plane consists of a map with all the available destinations. The user can click directly on the map and get to the destination. If the number of places rises, in typical 2D-maps the problem of available space becomes vital. All available places must be visible and ordered in a way that makes it easy for a user to find them. To overcome this problem, in many cases the whole space is structured into several separate maps, forming a "layered" structure. This results in loosing the "one-click-navigation" option.

Finally, three-dimensional navigation is defined here. Three-dimensional navigation seems to be the most natural navigation for humans because humans live and navigate in a spatial world. However, three-dimensional navigation with a mouse and a two dimensional screen is not by default easier than the other mentioned navigation schemes. 3D navigation can be performed in at lest two different ways: The user can either click on the target on a three dimensional map (comparable to the 2D map approach above) or he/she can navigate through a system of spatial units, e.g. rooms and virtual environments. Both approaches will be discussed below. In the case of web-based applications, no special equipment for navigation or orientation is needed: no glasses, helmet or gloves. We restrict ourselves to conventional devices, the mouse and the 2D screen.

Objective

We took a classical application area for web based services today and designed the navigation component in a way to fulfil some functional requirements. Our sample application is a medium size online store. The objective was to identify means of navigation and problems with learning and using the various navigation mechanisms. The special focus in our application was on making three navigation options available in parallel. We wanted to give the user the free choice to navigate in the way he/she wants. More details can be found in the section "Our approach".

The scientific problem to identify navigation preferences and methods needed a typical usage scenario with "real" users who served as test subjects an thus delivered a vast amount of data which we had to evaluate carefully (see section Observation/Evaluation). Instead of creating a genuine e-learning application, we covered the e-learning process by a "real" web based shopping process. The learning was done unnoticed by the user but very carefully observed by our system.

Related work

A lot of research has been performed on navigation in web sites. In [4] Pilgrim and Young discuss in detail the various possibilities to map a web site on a two-dimensional map and navigate in it. Menu navigation is covered in [5] and [6] and numerous other papers. In particular Don Hopkins describes in [1] the pie menu approach in

detail. Three-dimensional navigation is covered e.g. by Mallot and Gillner in [7] and [8]. The authors of the present paper gave an overview over classes of virtual environments in [9], highlighting the capability for users to move and navigate as one central differentiation aspect of classification. The tool to trace users' activities in virtual environments was first described by one of the authors in [2]. The User Tracing was used there to optimise a pure 3D environment.

Our approach

We carefully designed an application that offered all three types of navigation concurrently. Since a three-dimensional interface does not make sense in a purely business oriented application, we chose to realize a good-looking, experience oriented shop with interesting objects which the users could really inspect in 3D and (optionally) buy. Navigation learning happened completely in the background.

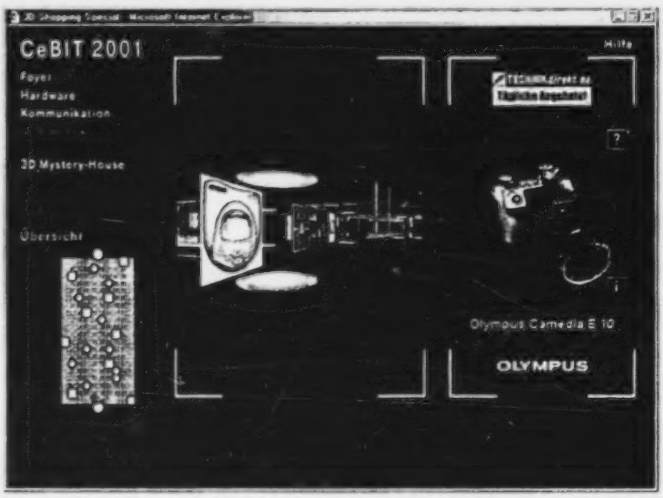

Figure 1: Screenshot of our application with menu navigation (upper left), map-navigation (lower left) and 3D navigation (centre). Note that all three navigation widgets are synchronised.

Thus we picked the "natural walking" approach for three-dimensional navigation and not the "3D-map" approach. The User can walk in four rooms, each containing a set of related objects. The rooms where designed in a way to make walk-navigation as easy as possible. We tried to avoid traps and dead ends, which could confuse or annoy novice users. However, if free navigation is enabled, one can never make sure that a user does not stand in front of a wall, seeing nothing but the wall. Our goal was to identify such situations in real world conditions.

In addition to the free walk-navigation, we implemented a target oriented navigation scheme: We (automatically) assigned "viewpoints" to each object that was to be sold in the environment. The user can reach each viewpoint in three different ways:

1. If the user clicks on an object of interest (a product), which he/she sees in from a distance, he/she gets moved to the corresponding viewpoint. We call this "passive walking" since the user keeps the feeling of immersion and constant orientation (as with active walking) but he is exempt from the walking activity and thus cannot get stuck in traps or dead ends. Reaching an object always takes a certain amount of time (e.g. two seconds, adjustable).
2. Viewpoint hopping: Using the computer's keyboard (PgDn-key), the user can move from viewpoint to viewpoint (object to object). This gives the opportunity to see all relevant places, but it limits the navigation to a single path of direct connections between objects (viewpoints). Using this navigation method the user might miss interesting places which are not in the list of predefined viewpoints.
3. Using a mechanism build into the 3D-browser we used, a user can also open a text based list of viewpoints and jump directly to any of these viewpoints. We did not stress this navigation style very much because it implies a quite complex mental context change and also makes the users loose the feel of seamless navigation.

The user/learner can change back to "free navigation" at any time while working with any of these three viewpoint based navigation methods.

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We found that the pre-installed method of picking a viewpoint by its name from a list was rarely ever used. To pick a viewpoint by its' name it must be assigned a good name before. This is not always the case, especially those viewpoints inserted automatically by some process generating a 3D-world often do not have useful names, rather they have no name at all.

Our 3D environment consists of three large rooms, each with objects of one category in it. In addition we provide a "foyer" room as an entrance region and for special purposes. The learners can pass from one room to the others by clicking on the respective doors.

In addition to the 3D navigation, we provided a 2D map that showed the current position and orientation in the room as a small red triangle on a 2D sketch. Users could navigate here and access several targets directly. The map corresponds to the layout of the 3D rooms which where visible at all times.

Finally we implemented the traditional menu-style navigation: The user can click on the words in the menu located in the side bar, representing categories of our shop, and directly get to the places denominated here. Since there are no really innovative aspects in this method, we put no special effort in this aspect and just realized a standard tool. However, the two other navigation methods and tools needed to be updated constantly and thus added a new feeling to the menu navigation.

What's new?

The navigation methods above are quite well understood in scientific terms when examined individually. Even though the 2D map navigation is not very widely used as a navigation metaphor, similar techniques are used to interact with objects and widgets on a 2D screen. This form of interaction can also be viewed as navigation. However employing a combination of one, two, and three dimensional navigation metaphors as well as utilizing carefully tuned navigation tools is not investigated in a great detail up to now. In particular our use of the environment to monitor the learning process of the participants is a novelty.

Traditionally, most evaluations of learning and navigation behaviours took place in closed labs under controlled conditions. This makes it possible to eliminate external effects on the users behaviour and performance and also a controlled observation of the participants' actions can take place. We do not follow this tradition.

The large scale usage evaluation tool and method

Our approach aims to reach almost the same quality of results but without utilizing a lab and thus without the disturbing effects of learners who are always aware of being closely observed. To reach this aim, we chose two measures:

1. We expanded the number of "participants" to a really large order of magnitude in order to minimize statistical error effects. Thus we can assume a quality of the results that is comparable to those from lab experiments.
2. We designed and implemented a tool that resides inside the actual application and anonymously records all learner actions and evaluates them preliminarily. This User Tracing Tool records the paths learners walk along in virtual environments, the objects he/she sees (or cannot see), and the interactions with objects in the application [2].

In particular the role of the tracing tool cannot be overestimated: This tool collects and anonymises valuable information and plays the role of a human observer/teacher in lab experiments. We are aware of the potentially less accurate information this tool provides. In particular the tool cannot measure/detect anything which is not planned by its' designers. But the sheer number of instances will reduce the negative effects and level out potential error sources. With our evaluation approach we were able to identify a couple of new findings and to confirm a few old results on learning and navigation techniques, problems and methods. The following section will go into detail here.

Implementation

The whole system was designed to be used under real world conditions, and eventually it was in use at a major European portal site in the shopping area. We implemented a distributed system consisting of a regular web server (Apache) running in a Sun Solaris environment. The web site itself was implemented in HTML 4.0 using frames to structure the areas of interaction and to separate the various technologies used therein.

The 1-D navigation in menu style was implemented in plain HTML and JavaScript. The 2D-map style navigation used Java to display the map and the user's position and orientation. The 3D environment (consisting of three rooms and one foyer) was implemented in VRML 97 including scripts (in JavaScript) and more technologies provided by the VRML specification, e.g. prototypes. The synchronisation was implemented in Java.

For the evaluation tool, we used a combination of VRML-features and proprietary Java classes. These collected the information and sent them to our evaluation server. This server runs a set of Java-servlets, a MySQL DBMS (any relational database would be possible) and an HTML based front end for the administrator, see [2] for details. The whole distributed system supports distributed load balancing for maximum performance.

Observation/Evaluation

During a fixed period of time (6 weeks in April/May 2001) 40.000 people visited our site and learned how to navigate therein. We thus had a real big number of learners who used our various navigation mechanisms. We measured the number of visitors per day and during the day. The usual log-files of the web server provided us with this sort of information. The log file evaluation resulted in no major surprises: The number of hits increased over time until it reached a state of saturation an remained at this rather high level until the end of the public presentation. Since this is a typical development in the selected shopping environment, we can assume our other observations about learning behaviours to be applicable to other web applications as well.

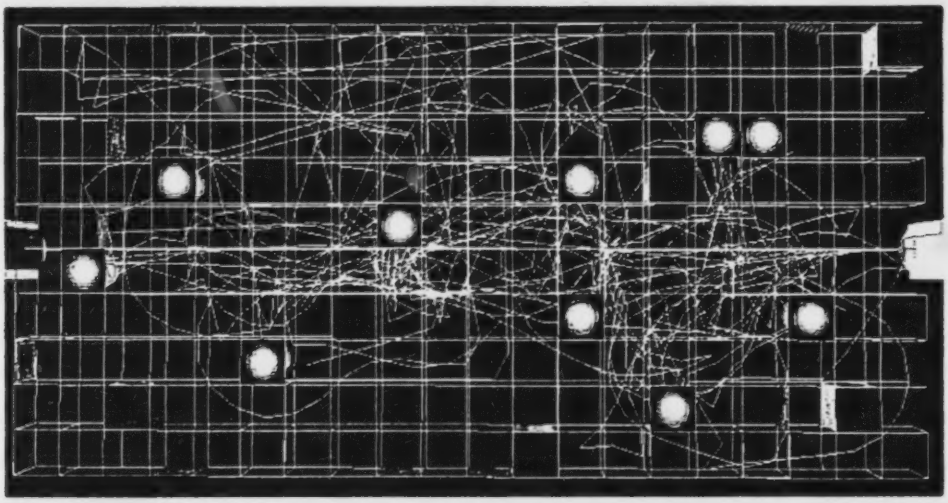

Figure 2: An extract of 15 visits to the 3D Web site. The paths the learners used are drawn as lines. The entrance to the room is on the right; the bright spots indicate objects on display. Note that some areas have been visited more often than others.

According to the three different styles of navigation we found that most learners used a combination of at least two methods:

1. For larger context switches (jumps from one catalogue/room to an other one), the menu-style navigation was used most often. This might be a result of the fact that the top-level targets have been visible at all times with no additional navigation/interaction necessary (such as walking to a door etc.).
2. The 2D-map was not used very intensively. Most users used the map simply as an orientation aid while navigating in 3D. For this role, the map was suited very well. In contrast, the map was not very effective for the target-orientated navigation. One reason might be that the map was quite small and did not show all products with their names and/or pictures simultaneously.
3. Within a single catalogue/room, three different ways to navigate have been identified:
   a. One type of learner preferred the efficient way to "be navigated" by clicking on a target or by utilizing the viewpoint-hopping option. We called these people the "structured browsers": they usually visited each and every object in the room and then returned to one or two objects of particular interest for them.
   b. The "3D novice": A few people did not navigate in 3D at all after starting the application. These learners sometimes used the menu to a certain extend, but in most cases they kept passive completely. From the verbal feedback that we received, we can conclude that these people expected that the application would be self-animating and just "flashy" as some of today's web sites tend to be. These "3D novices" just did not recognize that interaction always means action by them too.
   c. The "free floating explorer": A remarkable number of learners used the possibility to walk everywhere in the environment. These people learned their lesson fast and visited some of the objects but also closely examined parts of the world, which were added just for entertainment purposes. Doing so they usually

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spent much more time in the 3D environment than the other two types of visitors. This in turn caused them to perceive additional information (advertisements) much longer than the others.

4. For the inspection of the goods on display, almost all users preferred to rotate and activate the objects in 3D space. Only the technical information and the price were read in a separate 2D-window (this information has not been available in 3D).

In general the experiment produced a number of interesting results and feedback, which was in most cases very positive or enthusiastic. The learners made progress according to their individual capabilities. More important: Our approach and the new tool provided us with lots of useful information about the learning process in complex navigational tasks.

Conclusion and future work

As mentioned above, the integrated concept of various navigation styles was a scientific and economical success. The users appreciated the new freedom to choose their favourite style for different tasks and they learned to exploit this freedom of choice. The new approach proves to be more effective and at the same time more interesting and entertaining than pure 2D or pure 3D learning and navigation, not to speak of austere menu navigation.

However, the new approach also results in more work during the web site creation and CBT-applications. In particular the synchronisation between the three components is a challenging task. Our proposed solution is to use (semi) automatic web site (online course) generation from a content management system. This will be one focus of our future work.

An other area of future work will be the optimisation of the two-dimensional map. We are currently considering the continuous zoom approach by Bartram et al. [3]. Applying multiple scales simultaneously to one complex map might also be a step forward to a seamless integration of 2D and 3D in one window/frame and thus ease the learning curve of new users.

Finally, we have to support the novices more effectively. In a different context we added automatic animation and passive navigation after a certain time of inactivity. We intend to make use of this technique in the present application scheme too. This will hopefully activate the learners and improve the training effects.

Acknowledgements

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Information Design as Language Work: Developing University Curriculum in Co-operation with IT-professionals

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Language work today is a complex field, permeated and transformed by the accelerating development of new technologies for collaborative work and communication. Current university curricula require a careful and critical look in respect to the challenges this situation sets to the education of future language professionals. In this poster, we shall describe the context, starting points and processes of the collaborative planning of the new study programme on the theory and practice of language work, especially technical communication at the English Department of the University of Oulu, Finland. The work has advanced in close collaboration between university staff and students as well as language and IT professionals in working-life. The project also aims at developing the curriculum to the direction that supports flexible study in the workplace as the language professionals of today are often students or postgraduate students who wish to pursue their studies intertwined with their everyday work.

Finding a Link Between Social Interaction and Learning in Online Courses

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Computer-mediated communication is frequently incorporated into the design and delivery of distance learning courses as it allows for social interaction that is time and place independent among online learners. Social constructivist learning theory, currently the most accepted epistemological position associated with online learning, views social interaction and collaboration with others as the vehicles through which knowledge is constructed (Kanuka & Anderson, 1998). Frequently social interaction is touted as responsible for more productive learners, higher levels of learning, and creation of learning projects that isolated, independent learners could not produce working alone.

Project TELL: A Web of Practitioners

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Abstract: The Technology Enhanced Lending Library (TELL) is a resource open to all University of Illinois College Of Education (COE) faculty and teacher education students. It comprises a growing collection of educational resources that span the curriculum and pull from all teacher certification disciplines (e.g., science, math, language arts, etc). The library of software tools is searchable via the World Wide Web, making it easy for faculty and students to discover software tools. More importantly than accessing the library holdings, the TELL website provides a forum for practitioners to identify and share information concerning these materials. As faculty and students use the resources provided by the library, they are asked to critique the software on multiple dimensions. The feedback is entered directly into the database via a web form.
This short paper will focus the development of this site and the special considerations for its design and maintenance. In addition we will demonstrate the Project TELL website.

In an effort to bring about educational reform, Illinois, like many states, has changed to a standards based competency model and adopted new accountability procedures that demand results from students, teachers and schools. These standards and procedures follow the lead of current research in education, requiring teachers to have substantial background in both content and pedagogical knowledge (Ball, 1994; Ball & McKiarmond, 1990; Seixas, 1998; Shulman, 1986; Zeidler, 1999). A strong push in the standards movement is toward the use of technology enhanced instruction. In many cases however, this call has been seen as just another demand in a long list, and one unrelated to the mandates to develop students' domain-relevant thinking skills. As a result, teachers most often use computer technologies to support "drill-and-kill" exercises, with little impact on the development of higher-order skills such as domain-relevant inquiry, synthesis of multiple perspectives, etc (Benton foundation, 1998; Piller, 1992).

The root of this problem begins long before a teacher reaches the classroom however. What teachers typically learn in their studies is what they teach (Ball & McDiarmid, 1990; Stoddart et al., 1993; Stofflett & Stoddart, 1994). The traditional model for technology education centers on a single technology competency course or multiple competency modules. A recent research study, put out by the International Society for Technology in Education (ISTE) (Moursund & Bielefeldt, 1999), examined this model of technology integration and found it inadequate. The report clearly states no correlation exists between formal instructional technology courses and instructional technology utilization by K-12 classroom teachers.

Effective technology infusion in the classroom requires coursework that fosters the development of content-rich, pedagogically sound strategies that make technology an integral part of the learning process. This can only be accomplished through the infusion of technology throughout the entire teacher preparation curriculum.

Compounding this issue is the reality that the journey from student to teacher involves three parties. Faculty in colleges of education are responsible for providing much of the pedagogical and content background needed to develop successful teachers. Inservice teachers provide practical experience and mentorship based upon the realities of K-12 classrooms. Finally, students provide the motivation and desire to become certified teachers who can impact the lives of children. Yet, the boundaries between these three important groups can be impermeable, impeding the development of successful classroom teachers. The boundaries are symptomatic of a lack of communication and sharing of resources among the three groups.

A new mechanism that facilitates technology infusion across the curriculum and assembles these three vested parties in a community of practice is needed. Technology can play an important role in developing and maintaining this mechanism. Specifically, internet technologies provide the ability for many people with like interests to interact with one another, pose questions and receive answers, and share classroom resources.

Based upon these features, the College of Education at the University of Illinois at Chicago has created a web site designed to encourage technology infusion by a community of practitioners across university and k-12 settings. Specifically we have developed a web accessible cross-curricular CD-Rom software lending library and a communication database.

The Technology Enhanced Lending Library (TELL) is a resource open to all COE faculty and teacher education students. It comprises a growing collection of educational CD-Rom resources that span the curriculum and pull from all teacher certification disciplines (e.g., science, math, language arts, etc). TELL also has a wide variety of software tools to expose users to titles that go beyond traditional drill and tutorial software to packages that encourage mindful and meaningful thinking and problem solving that can be used in a variety of contexts. The library of software tools is searchable via the World Wide Web, making it easy for faculty and students to discover software tools.

More importantly than accessing the library holdings, the TELL website provides a forum for practitioners to identify and share information concerning these materials. As faculty and students use the resources provided by the library, they are asked to critique the software on multiple dimensions. This information includes ease of use, integration possibilities, lesson plan suggestions, likes and dislikes. The feedback is entered directly into the database via a web form. In this way the database is generative in nature and helps to form a virtual community of technology practitioners who add to the knowledge base about what constitutes best practice using educational technology. The information supplied can be used to select a resource, find a new function for a particular resource and get faculty and teacher candidates communicating about ways to use technology in the classroom.

While the web can be used for many things from an information source to a resource finder, these abilities invite individual endeavors. The TELL website goes beyond these to create a community of practitioners who can serve as resources for one another. This approach requires special considerations for design and maintenance of the system. For example, we needed to create a user friendly interface that required no training or specific technology skill. We addressed this matter by using webforms for searching and entering information in the database. In addition, we needed to attract and sustain users that would not normally seek one another out for technology advise. Users who registered for on TELL were given software vouchers to purchase new titles for the library. Individuals who repeatedly used TELL were spotlight guests on the instructional technology resources webpage (which can be listed for annual review as well as on a portfolio). These are just a few of the issues which will be discussed in the presentation along with a demonstration of the Project TELL website.

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End-User Satisfaction in Training Novice Users to Surf the Web

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Abstract

The user population of the world wide web is increasing rapidly. People who have never had experience with computers are logging on and therefore, the novice user population is very large. These new users need to be trained in using this new technology. It is therefore important to investigate which training methods leave the users most satisfied. This paper presents the results of an experiment designed to assess user satisfaction with different training methods. Over 250 users took part in this experiment, measuring user satisfaction with eight different training methods. There were not major differences in user satisfaction across training methods, but overall, satisfaction scores were very high. This might mean that the users were in serious need of training, and were satisfied to have received training, regardless of the type of training.

Introduction

As the popularity of the World Wide Web grows, many people without previous computing experience are getting on the web (Lazar, 2001). The user population of the web includes people of all ages, gender, educational experience, computing experience, and disabilities (Shneiderman, 2000). Because the number of people who need to use the web is increasing, the number of people taking training classes related to the web is also increasing. Computer training is an important component of implementing a new technology. In some cases, professionals such as teachers are being required to take training classes in using the web (Wax, 2000). Newspaper articles are heralding the importance of computer training for using the World Wide Web (Mendels, 1999). In most cases, without appropriate training, users will not be able to effectively use the technology (Hoffer, George & Valacich, 1999; Lazar & Norcio, 2000a; Office of Technology Assessment, 1995; Whitten & Bentley, 1997).

Since training in using the web has become necessary for a large number of people, it is important to research the effectiveness of different training methods for the web. Training can be presented in a number of different ways. For instance, training sessions can differ in how the material is presented to the users, what documentation is provided, or the amount of instructor participation. For instance, will the training be presented by telling users to type in certain commands, or will users be encouraged to explore? Will users be instructed on what errors could occur, and on how to respond to those errors? Which training methods will leave the user most satisfied? These are important research questions which this paper will address.

Training Users in Responding to Errors

In addition to the many considerations in a training session (such as room layout, lighting, time of day, documentation), there are a number of different approaches for presenting the training itself. For instance, users could be told exactly what to type in, or users could be encouraged to explore on their own. Training approaches can differ depending on whether they address the issue of errors, and if so, how they address those errors. Errors need to be addressed when training novice users, because errors occur frequently with novice users who are attempting a new comp uter task, and in the networked environment of the World Wide Web, there is an increased likelihood of error occurring (Greif & Keller, 1990; Lazar & Norcio, 1999b; Lazar & Norcio, 2000b; Lazonder & Meij, 1995). Errors can frustrate novice users, who tend to blame themselves for errors (Arnold & Roe, 1987; Carroll &

Mack, 1984; Frese, Brodbeck, Zapf & Prumper, 1990; Lewis & Norman, 1986). In addition, novice users may spend a lot of time attempting to recover from an error sequence (Carroll & Carrithers, 1984). Even though errors are such a problem for novice users, unfortunately, most training methods for novice users do not address the errors that can occur (Frese & Altmann, 1989).

A number of methods for addressing errors in novice user training have been presented in the literature (Lazar & Norcio, 1999a). Some of the different approaches to training users to respond to errors include error management training, exploratory training, and conceptual models. In error management training, errors are presented as opportunities for learning (Dormann & Frese, 1994; Frese & Altmann, 1989; Frese et al., 1991; Nordstrom, Wendland & Williams, 1998). In error management training, users are informed about the errors that may occur, and are instructed in strategies for coping with errors. Errors are presented as a positive step, rather than a negative setback. In exploration, users are given an overview of their environment (Greif & Keller, 1990; Wendel & Frese, 1987). Instead of being given step-by-step directions, users are taught how to navigate through their task environment. For instance, instead of being told to type in a specific command, such as Acd WWW≅ the user will be presented with an explanation of what the Acd≅ command is, and what options exist. The idea behind exploration is that users will have a better understanding of their environment, and therefore be better prepared to respond to the unexpected. Conceptual models are graphical or mathematical representations of a system that correspond closely to the real-world system (Santhanam & Sein, 1994). For instance, a conceptual model of the Internet might display how the user=s computer communicates with numerous servers, to access the web page that the user has requested. Conceptual models assist users in understanding systems, and predicting the actions of systems.

An important consideration related to the presentation of training is which training methods will leave the users with a high level of satisfaction. Since novice users are frustrated by errors, the expectation is that training methods that address errors should have higher levels of satisfaction, since the users will be better able to address errors, and therefore will become less frustrated. For instance, in two studies on error training in non-networked applications, subjects who received training in how to respond to errors reported lower levels of frustration than subjects who did not receive any training in responding to errors (Frese et al., 1991; Nordstrom et al., 1998). Users should leave a training session with a high level of satisfaction, confident that they will be able to tackle the computer tasks when they return to their standard (workplace or home) computing environment.

We have created a research framework, which shows that by examining the training methods previously discussed in the research literature, some new hybrid methods of training have yet to be explored (Lazar & Norcio, 1999a). In addition, only one of these training methods (conceptual training) has been tested in the networked environment, where there is an increased opportunity for error. The resulting combinations of training methods can be seen in Figure 1.

Research Methodology

The research framework was used as the basis for the present experiment. Based on this research framework, eight different approaches for training novice users to use the web were tested. In total, 263 subjects (novice users) participated in the experiment. A novice user was defined as someone who has 1) not previously taken a class in using the Internet, and 2) does not use the Internet as a regular part of their job. In addition, university students were excluded from the experiment, because they do not accurately represent the average novice user. The treatment groups in the experiment are displayed in Figure 1. The subjects were randomly assigned to treatment groups. Treatment group H is the control group, where subjects did not receive any assistance in responding to error. The average age of the subjects taking part in the experiment was 50.3 years old (std. dev. 9.9 years)

Treatment Group	Conceptual Model (CM)	Error Management (EM)	Exploratory Training (ET)	Training Methodology Name
A	Yes	Yes	Yes	Networked Error Training
B	Yes	Yes	No	Conceptual Error Training
C	Yes	No	Yes	Conceptual Exploratory Training
D	Yes	No	No	Conceptual Training
E	No	Yes	Yes	Error Training
F	No	Yes	No	Error Management Training

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G	No	No	Yes	Exploratory Training
H	No	No	No	Traditional Training

Figure 1. Treatment Groups

Each training session lasted four hours. The same protocol was followed in all of the training sessions:

1. Subjects filled out human subjects forms, describing their rights in the experiment, as required by university policy and federal law.
2. Subjects received a three hour training session. The training presented to them depended on which treatment group the training session belonged to.
3. Subjects were given a list of 10 information gathering tasks on the World Wide Web, and subjects were given an hour in which to complete these tasks. The correct answers to these tasks could not be guessed, and there was only one correct answer for each task. The specific tasks, as well as the results of the information gathering tasks, have been reported in (Lazar & Norcio, 2001).
4. As soon as the subjects had completed the tasks, they completed the satisfaction questionnaire.

In the experiment, data was collected on the task performance of the subjects, as well as the time performance of the subjects. In a previously published paper, it was reported that exploratory training was the most effective for improving task performance, and exploratory training and conceptual models were most effective for improving time performance (Lazar & Norcio, 2001). Data on user satisfaction was collected as part of this experiment. The goal was to learn if there are any differences in user satisfaction related to the type of training method presented. This paper reports on the findings of the satisfaction data.

The satisfaction questionnaire was based on the Questionnaire for User Interaction Satisfaction (QUIS) (Norman, Shneiderman, Harper & Slaughter, 1998). The QUIS is a standard tool for evaluation of user satisfaction, which is used widely and has been previously validated in the literature (Chin, Diehl & Norman, 1988; Harper, Slaughter & Norman, 1997; Shneiderman, 1998; Slaughter, Harper & Norman, 1994). The QUIS is relatively long, and therefore only certain parts of the QUIS were used in the experiment. The different sections of the QUIS are designed to be used separately, as needed (Norman et al., 1998). The part of the QUIS that was used in the study is Part 3 (Overall User Reactions). The other parts of the QUIS, such as questions about teleconferencing, technical manuals, and software installation, are not relevant to this study, and therefore were not included. The parts of the QUIS used in the satisfaction questionnaire are the dull-stimulating scale, the terrible-wonderful scale, the difficult-easy scale, the frustrating-satisfying scale, and the rigid-flexible scale. These scales represent overall user satisfaction with their experience. The actual satisfaction questionnaire used in the experiment is displayed in Appendix A. An earlier pilot study of 16 users found that there were no problems in the clarity of the satisfaction questionnaire.

Results

The mean satisfaction scores of subjects are displayed in figure 2, organized by the training methods that the subject received. ANOVA tests were then performed to determine if there were any statistically significant differences (Maxwell & Delaney, 1990). There are no statistically significant differences between any of the training groups on the dull-stimulating scale, the terrible-wonderful scale, or the difficult-easy scale.

Figure 2. User responses on scales of satisfaction

Group	Terrible	Frustrating	Dull	Difficult	Rigid
A	7.9429	7.1714	7.8889	6.4167	8.0833
B	7.1905	7.0000	7.4762	6.3182	7.4762
C	7.3182	6.2727	7.5000	6.1364	8.0476
D	7.6000	7.1522	7.7045	6.2045	8.0930
E	7.5641	7.2895	7.7632	6.9487	8.2895
F	7.6522	6.7826	7.6522	5.9565	7.4783

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G	7.9143	7.6857	7.8824	6.8000	8.2857
H	7.9375	7.6774	8.1250	7.0625	8.3750
Avg.	7.6746	7.1912	7.7760	6.5217	8.0723

Figure 2. User responses on scales of satisfaction

On two satisfaction scales, the frustrating-satisfying scale and the rigid-flexible scale, statistically significant differences were found. A Duncan=s post-hoc test was run to determine where the statistically significant differences were. On the frustrating-satisfying scale, there is a significant difference between Conceptual Exploratory Training (Group C, with a mean of 6.2727) and Exploratory Training (Group G, with a mean of 7.6857) and Traditional Training (Group H, with a mean of 7.6774). On the rigid-flexible scale, there is a significant difference between Conceptual Error Training (Group B, with a mean of 7.4762) and Error Training (Group E, with a mean of 8.2895), Exploratory Training (Group G, with a mean of 8.2857) and Traditional Training (Group H, with a mean of 8.3750). There is also a significant difference between Error Management Training (Group F, with a mean of 7.4783) and Error Training (Group E, with a mean of 8.2895), Exploratory Training (Group G, with a mean of 8.2857) and Traditional Training (Group H, with a mean of 8.3750).

Discussion

In this experiment, subjects were asked to fill out 5 different scales of satisfaction from the QUIS, the dull-stimulating scale, frustrating-satisfying scale, terrible-wonderful scale, difficult-easy scale, and the rigid-flexible scale. There were only a small number of statistical differences in satisfaction between training groups, and these statistically significant differences appear only in two of the five scales of satisfaction. In the two scales where statistically significant differences did appear, the statistically significant difference is generally between the highest and lowest groups, not between one or two groups and ALL of the other groups. If there are truly significant differences in satisfaction, it is expected that it would appear on more scales of satisfaction, or statistically significant differences would appear between more of the training groups. Therefore, it does not appear that there are any meaningful differences in the user satisfaction of the subjects related to training methods. It is important, however, to note that all of the satisfaction scores were very high.

There are no major differences in satisfaction across the training methods of the experiment, but all satisfaction scores were very high. This is a very interesting finding. One of the requirements for subjects was that they had not previously taken a training class on using the Internet. It is possible that subjects had been staring at their computers, wondering about what the web is, and how they could use the Internet, for months before taking part in the training session. In this study, the training was offered to the employees at no cost. These employees might have been Astarved≡ for training, and might have simply been satisfied with having received training - *any type of training*- at no cost. Although the task and time performance varied greatly depending on the type of training received (Lazar & Norcio, 2001), the satisfaction level did not. Subjects might have been satisfied simply because *they had received training*, and now had more knowledge and felt more confident using the web. This concurs with a number of recent newspaper articles, which described users who were worried and uncomfortable using the web because they had not received training (Mendels, 1999; Wax, 2000). At this point of rapid growth in computer technology, the important factor in user satisfaction may not be related to the TYPE of training, but rather to having received training at all.

Systems analysis and design and management information systems textbooks note that training is a very important factor in the user having a successful computing experience (Hoffer et al., 1999; Martin, DeHayes, Hoffer & Perkins, 1994; Whitten & Bentley, 1997). It is therefore distressing to note that in many cases, training may not be affordable or might be the first thing to be cut out of the budget, especially for schools and other non-profit organizations (Lazar & Norcio, 2000a; Mendels, 1999; United States General Accounting Office, 1998). When non-profit organizations do spend money on training users, the training budgets are usually very low (Benton Foundation, 1997; Office of Technology Assessment, 1995). More community partnerships and unique approaches need to be developed to ensure that users receive the training that they need, to ensure that the technology gap between the Ahaves≡ and Ahave-nots≡ does not grow wider (Lazar & Norcio, 2000a).

Summary

An important finding of this study is that users want training. There were not major differences in the user satisfaction related to the different training methods. Rather, the novice users were very satisfied to received training at all, regardless of how the training was presented. This concurs with findings that without training, users are not successful in effectively utilizing information technology. Training needs to be made a priority in information technology budgets, to ensure that users can effectively use new technologies.

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Appendix A. Satisfaction questionnaire

Please circle the numbers which most appropriately reflect your impressions about this training experience. (Not Applicable = NA)

terrible wonderful
1 2 3 4 5 6 7 8 9 NA

frustrating satisfying
1 2 3 4 5 6 7 8 9 NA

dull stimulating
1 2 3 4 5 6 7 8 9 NA

difficult easy
1 2 3 4 5 6 7 8 9 NA

rigid flexible
1 2 3 4 5 6 7 8 9 NA

Creating The Virtual Classroom With Evolving Technology Users

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The virtual classroom has the potential to enhance the educational productivity with a multimedia visual learning environment, broaden capability for global connectivity without the limit of time and space, and reduce costs of distribution while expanding academic territories. The main goals of this article are to explore types of interaction supported in the virtual classroom, design a virtual classroom for interactive education on the Web, and integrate advanced technologies for the virtual classroom.

Keywords: Virtual Classroom, XML, On-line Conferencing, High Bandwidth

1. Introduction

The World Wide Web and other Internet-based collaborative tools have significantly enhanced the ability to train and educate electronically. The Web, when combined with other network tools, can be used to create a virtual classroom to bring together a community of learners for interactive education. Web-based conferencing uses software, modems, and computers to bring geographically dispersed individuals into a "virtual" classroom for instruction, discussion, and collaboration. Use of on-line conferencing is expanding at all levels of education, particularly in higher education. This was very evident in the number of sessions devoted to on-line conferencing at the most recent EduCause Conference, "The Networked Academy," held in Seattle, Washington, December 8-11, 1998 (Charp, 1999). The virtual classroom is the concept that the world is our classroom, that distance learning serves students wherever they may be (Hawes, 1998). The main goals of this article are to identify types of interaction supported in the virtual classroom, design a virtual classroom for interactive education on the Web, and integrate advanced technologies for the virtual classroom.

2. Types of Interaction Supported

Learning is fundamentally a social experience. Interactivity differentiates a course from independent, self-directed study, maintains the community of discourse and helps define and re-construct the body of knowledge (Anderson, 1999). Feedback crucial to the development of community and critical thinking interaction serves to stimulate and motivate. There are types of interaction supported in the virtual classroom.

The first type is asynchronous interaction which provides freedom of time, so that learners participate when, and if, they choose time for reflection, opportunities to research and back-up one's assertions allows global communication, un-bounded by time zone constraints greater anonymity and potential lack of responsibility by individual users. Major asynchronous tools include E-Mail,ListServ, Email lists archived using HyperMail, and Newsgroups. The examples are WebCT from UBC, Virtual University, Electric Minds virtual community center, WEbBoard at U. of A. Department of Psychology, Soft Arc's First Class, Lotus Note's Learning Space,Basic Support for Collaborative Work (BSCW) Project.

The second type is synchronous interaction which provides immediacy, faster problem solving, scheduling, and decision making increased opportunities for developing affect better for class parties. The major Internet based synchronous tools are internet voice telephone, text-based chat systems, text-based virtual learning environments, graphical virtual reality environments, net-based virtual auditorium or lecture room systems, and video teleconferencing.

Most internet based voice telephone supports one-to-one communication only. Video teleconferencing is generally small image size and slow refresh rates for video, but CaNet2 and other next generation networks will see improvements. Microsoft's NetMeeting and CuSeeMe support multi-point video conferencing through use of a "reflector site" - however the more users, the slower the picture refresh rate and poorer the audio quality. Text-based Chat systems run on almost any hardware, providing text only chat - some with separate rooms for different topics. Graphical Virtual Reality environments - Much easier to learn than text based systems, allow a sense of physical presence but at a cost of slower speeds and higher end user equipment requirements. Net-based virtual auditorium or lecture room systems - Newest entry providing voice communications and the features of a "smart classroom" (slides, application sharing, student voting and feedback etc.) at a distance. These systems also require higher end (Pentium class) machines and client tools or plug-ins some of which are not available for Macintosh and other smaller brand machines. Can best be described as experimental, but great potential for post secondary distance education, in that the need for a "learning center" with specialized equipmnet is elim inated as delivery moves to the workplace or home such as Centra Software's Symposium system, Place Ware's Auditorium system, and Open University of the UK's Knowledge Media Institute's Stadium.

3. Designing An Interactive Virtual Classroom

Another issue, we must deal with concerns plans for creating a virtual classroom on the Web. Creating the virtual classroom has a lot to offer to anyone interested in designing distance learning (Clemens, Starke-meyerring & Duin, 1999). The more careful the plan, the more efficient the outcome will be. There are three key factors that we need to understand in order to establish a virtual classroom, including dealing with audio-visual equipment, exploring some different characteristics between the virtual classroom and a traditional classroom and conducting instruction for the virtual classroom.

Audio-visual equipment must be set up in the virtual classroom. In a physical classroom there is the standard set of audio-visual equipment, and tools that are available to the instructor. These might include a chalkboard, overhead projector, video cassette player, possibly a sound system, and even a textbook. Professional instructors know how to make the best use of these tools. The virtual classroom will need equivalent equipment and tools in the form of network-based software applications. Some of these virtual tools have a relatively long history on the Internet and provide obvious applications. Others are still emerging and their potential use in a virtual classroom is not yet understood. With the appropriate design, the students should be able to take advantage of these tools without leaving the comfort of their favorite Web browser interface. Dwyer, Dan, and Doerr, (1995) assert that some of those considered for our classroom are as follows. The first is the electronic textbook. In the area of high performance computing an example of a useful electronic textbook is the Computational Science Education Project (ORNL, 1994) sponsored by the U.S. Department of Energy. The growth of electronic publishing on the Internet should ensure a good supply of electronic textbooks over the coming years. The second is the electronic chalkboard. In an electronic course, the instructor might make use of the shared whiteboard offered by a tool like NCSA Collage (NCSA, 1994) to answer a question from a student. Such tools allow images to be displayed, manipulated, annotated, and shared between two people or among a whole group. The third is a video cassette recorder and a sound system. Use of mpeg movies and audio clips can be effective additions to textual materials. Dwyer, Barbieri and Doerr (1994) point out that we might create a "cartoon" to illustrate how messages are passed between processors in a distributed system or record the animated output of a parallel trace tool. The fourth is use of a listserv to redistribute e-mail questions or an usenet newsgroup are simple methods for sharing this interaction. A more dynamic question and answer period could be created using a chat session. For some types of courses a multi-user, text-based virtual reality, also known as a MUD (Multi-User Domain) or MOO (Multi-user domain Object Oriented), might be effective. An example of an experiment in this area is the Diversity University (Dinsdale, 1994). The fifth is video teleconference. The ability to use video teleconferencing could enhance electronic courses not only by transferring these more subtle forms of communication, but also by providing additional visual and audio cues which help the instructor and students to form an informal rapport. Work on the and with CUSeeMe have much potential in this area.

Different characteristics between the virtual classroom and a traditional classroom must be explored. Orlando-Morningstar and Buchanan (1996) list six rules that govern the on-line virtual classroom. First, an on-line conference is more an appropriate training medium for delivering new knowledge and creating attitudinal change than a medium for building skills. Second, rich content makes for successful training. Participants will continue to log on to an on-line conference if they perceive that they are gaining some benefit from the experience. If they do not perceive a benefit, they will not come back. Third, although the heart of the program will be the on-line presentations and discussions, participants will still need note-taking guides and supporting print-based material. A schedule of program activities should also be provided to serve as virtual beacons for participants as they move from one lesson to another. Next, on-line conferences require more reinforcement than face-to-face participants. Rich content, although critical, is often not enough. To correct this, the authors assert that on-line moderators have learned to remind participants that they need to include the conference in their daily work routine. Telephone calls to non active participants are often the most effective means of reconnecting individuals to the conference. Moderators print a hard copy of the on-line group discussion and fax or mail it to all participants to help them get back into the discussion loop. These and other reinforcing activities are necessary to successful conferences. Fifth, on-line conferences need as much facilitation as do face-to-face meetings. Imagine attending a seminar where the moderator asks a question, group discussion will ensue but dies down after only a few minutes. The moderator, instead of acknowledging participant comments and summarizing the discussion, moves to another question. The participants would either find the program not very interesting or would be quite confused. Finally, some groups just do better than others. Conference moderators will always need to employ these best facilitation skills to bring a group back on track. Sometimes a group conference call will be all that is needed to do the trick.

Instruction for the virtual classroom must be conducted. Getting started may not be easy. How to use the virtual technologies in the curriculum in order to raise academic success is the point. According to Hawes (1998), the following skills are the ones that must be taught in the virtual classroom are the main things to prepare teaching in the virtual classroom. First, teach the students to use the computer. Students suffer from information overload when they first learn about computer programs. They may be learning about operating systems, software, e-mail, and the Internet all at the same time. Consequently, they need lists of steps to follow. An excellent method of computer instruction is to treat it as an independent activity. Give the students a list of steps and let them progress at their own pace. A list of practice application steps that guides them through a simple project will help reinforce the skills. Second, teach the students to search the Internet. Internet search day is even more exciting. The colors and pictures are so enticing that it is hard to get students through the lesson in the allotted hour or so, but they must learn how to use the search engines and how to type in location addresses if they are going to conduct their own searches. Third, teach the students to read the sources. In the reading/study skills classroom or lab, instructors show students how to analyze the information they find on the Internet. Selections they read on the Internet extend and reinforce textbook lessons and issues. Next, teach the students to communicate. Encourage the students to communicate with the instructor about once a week through an office/lab visit or through e-mail to share concerns, questions, or amazing discoveries. Finally, teach students to enhance functional knowledge. An excellent introduction to the Internet for instructors is Randall Ryder and Michael Graves's "Using the Internet to Enhance Students' Reading, Writing, and Information-Gathering Skills" in the Journal of Adolescent and Adult Literacy (December 1996/January 1997). These authors continue to contribute so much to the enhancement of the reading classroom.

4. Integrating Advanced Technologies

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Advanced technologies in the virtual classroom must be integrated. Porter (1997) offers a philosophy of distance learning, one that emphasizes the value of using technology to enhance the delivery of quality education and training but also suggests that educators and trainers think critically about how, when, and where that technology can best be used. As Porter explains, distance learning "requires us carefully to evaluate our instructional methods and the technologies to establish communication among learners and educators/trainers" (xvii). There are several new technologies which will be used more frequently in the future classroom.

First, rich media technology improves better performances. The best online solutions incorporate a wide variety of rich media technologies in order to offer learners a comprehensive learning solution. With traditional methods, such as instructor-led classroom training, presentations are held at specific time in a specific place. With so many people working on different schedules and in different locations, it is often impossible to reach everyone. Even with newer methods of training, such as Webcasting, students must participate at a pre-determined time, making it potentially inconvenient and reducing the company's ability to get the right information to everyone. With web-based, on-demand rich media technology, however, information (using synchronized video, audio, text and graphics) is accessible at any time in any place. Rich media solutions also let learners find and repeat specific material again and again, increasing retention rates. For instance, if you are watching a rich media-based online training program and want to see part of the presentation again, you can simply search for the appropriate topics using sophisticated navigation tools, and play back the applicable part of the presentation. Plain "streaming video" technology designed for entertainment doesn't give you that option. Rich media presentations also can be re-accessed any time, allowing employees to take a "refresher" course if necessary. Rich media technology has unlimited uses, including: corporate, executive, and marketing communications; sales, field force and call center education; legally mandated compliance and certification; HR, motivational and leadership programs, and channel and customer communications. As rapidly evolving technology continues to shorten product cycle times, more and more institutes are realizing they need to communicate new products and education information to their learners as quickly and thoroughly as possible in order to maintain a competitive edge. By combining traditional methods with rich media technology, institutes can have the best of both worlds.

Second, high bandwidth benefits the virtual classroom. In the minds of many people, digital video and LANs are the oil and water of computer networking. movie-quality video requires a data transfer rate of up to 6 mbps. Similarly, a QuickTime video session of 1 Mbps from a file server can claims as much as 10 percent of Ethernet's bandwidth. Beyond bandwidth, multimedia demands isochronous transmissions, meaning that data must move at fixed intervals with little or no delay. But conventional LANs fall short in being able to deliver continuous data streams because they use half-duplex protocols, which are designed for the bursty traffic patterns intended for transmitting text and numerical data. For traditional data, the worst consequence of a LAN's start-and-stop nature may be a file transfer that pauses for a few seconds. But the digital video applications, pauses and disruptions in the data flow are annoying at best and, at worst, the causes of unintelligible information. Packet collisions and retransmission are a way of life for many LANs. With Etemet's bus topology, each device looks for a clear space to transmit. If traffic becomes heavy, multiple devices may try to transmit at the same time, and packet collisions may result. If a collision occurs, all devices must retransmit their data. This leads to even more collisions. This is why most network managers consider 40 percent of total bandwidth to be the maximum available bandwidth over an Ethernet network.

Third, XML, short for "extensible markup language", standards are too much of a good thing and are the next revolution. XML – the long awaited big brother to HTML – is becoming a reality. On June 22, Oracle announced XML interfaces for major programming languages. Jesse Berst (1999), Editorial Director, ZDNet AnchorDesk , wrote in his article " Four Reasons You're Gonna Love XML" points out the following advantages of using XML. First, a better way to search. Today a keyword search can return thousands of possibilities. Second, a better way to distribute and track information. Today it is difficult to republish content across many sites, and more difficult to track who is reading it. Tomorrow XML will make both a snap. Third, a better way to do business. Today you can browse catalogs online. Tomorrow XML tags will allow data to be customized just for you. Finally, a better way to do business . . . on the road. Today Web graphics bog down and slow Internet connections. Tomorrow your notebook will download only material tagged as text. XML is based on the same basic principles as HTML, short for Hypertext Markup Language, the lingua franca of the Web. But HTML is like a generic first-grade reader: simplistic and imprecise. In contrast, XML tags information with precise descriptions that open up new worlds of possibility. After being hyped heavily as a makeover for the Web, XML is starting to measure up. The consortiums and their giant backers are weighing in. Berst J. (1999) states that there are three main events influencing impact of XML. First, Oracle's announcement XML components that interface to development languages including Java, C and C++ on June 22, 1999. Second, Microsoft is supporting XML broadly in Office 2000. Third, IBM recently announced it would deliver an XML toolkit as part of its Web Sphere Studio.

Next, simulation technologies applies in the virtual classroom. Secretary of the Army has signed a $45 million contract with the University of Southern California to establish an institute to develop modeling and simulation technologies for military and educational purposed. According to Army officials, it wants to improve the realism and quality of its training simulations, leader-development exercises and the capabilities that it will look for in future weapons acquisition programs. The USC Institute for Creative Technologies [ICT] will be a joint effort of the Army, the entertainment industry and academy – an innovative team to advance dazzling new media and ultimately benefit training and education for everyone in America. This will revolutionize the way the Army trains its soldiers and how it rehearses for missions. Seven B. Sample, president of USC, says the ICT will develop technologies for synthetic experiences that will be so compelling, people will react as though they were real. "The key word is 'verisimilitude' – the quality or state of appearing to e true," he explains. "Verisimilitude will apply to simulation technology in the same way that the term 'high fidelity' has applied to audio." Researchers from the USC School of Cinema Television, the USC School of Engineering and USC's Annenberg School for Communication will collaborate with creative talents from the entertainment industry in the interdisciplinary research program, working to combine concepts of story and character will a rapidly increasing degree of immersion in the virtual reality technologies. The Army will employ these improved simulation technologies to rehearse for missions, for strategic planning through interactive battle scenarios, and for combat training, recruitment and equipment acquisition. The institute will pursue a combination of basic and applied research. Basic research will cover six areas: simulated "immersion" by users in the technological experience; networking and databases; search will be organized around a small number of long-term themes such as simulating futuristic "Army After Next" forces. While the Army and the entertainment industry share an interest in advancing simulation capabilities for specific purposes, these technologies offer clear potential to dramatically change training and education for all people.

Finally, conferencing software plays a key role in the innovative academic project. Due to an increasing number of off-campus students it was more difficult to coordinate appointments and physically meet with teaching assistants and other students. Hectic schedules the night before an exam make it hard for teaching assistants to accommodate all students and their questions. Both students and teaching assistants are looking for more efficient ways to use their time. The University of Cincinnati solved the problem by developing a model "virtual classroom", that can be used by anyone teaching a course at its main campus or at any of its branch campuses. The system, known as "Classware," was developed jointly by Academic Information Technology Services and the Center for Academic Technologies (Gordon, J. 1999). That is an advantage for the students as well as the faculty. Even a faculty member who knows nothing about HTML coding can take advantage of Classware. Classware requires very little knowledge about HTML. Now publishing on the Internet is as simple as filling out a form and making a few choices. It takes about 10 minutes to set up an electronic classroom. There's no paper, no waiting in line. Other similar programs are WebCT and Blackboard. WebCT is shorted for "Web Course Tools", which is a networked system designed to aid in the delivery and facilitation of online instruction and learning. It was developed by the University of British Columbia and is presently being used at varying levels by a variety of educational institutions worldwide. WebCT is a powerful tool that includes course design, question post, live chat, and student data management. It is charged by using a license. Blackboard can be downloaded free on the Internet.

5. Conclusion

In conclusion, the purpose of the virtual classroom is no different than that of the traditional classroom. However, life-long learning and off-campus students are increasing. Many advancement in education technologies are involved in the virtual classroom of the future. Those improvements will reinforce the education system. Curriculum Review (1998) reported that U.S. kids lead the computer technology revolution. Most American children feel quite com fortable in front of the computer screen, a recent Roper Reports Worldwide study reveals. Some 67 percent of U.S teens had used a computer in the past month. About 54 percent reported using computers at home, while 78 percent had used them at school. The virtual classroom is essential for the 21st century in education. To prepare for the next generation, we need to identify the benefits and limitations of on-line conferencing, create a virtual classroom for interactive education on the Web, and integrate new technologies in the future virtual classroom.

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Transforming a Master's Degree Program to Full Web Delivery

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Transforming a Masters Degree program from the traditional delivery format to full Web delivery occurs with the right combination of faculty enthusiasm, technological capabilities, administrative support, student interest, and the recognition of instructional possibilities. The Educational Media Masters program recently completed the transition from traditional face-to-face delivery to online delivery. The three-year process for developing a fully Web-based degree was supported by strong and consistent administrative support as well as a team of highly trained and competent technical support staff. The Educational Media Program Coordinator worked closely with the administrative and technical team to develop a program that meets accreditation standards, provides a successful learning experience for Ed Media online students, and supports the UCF Distance Learning Initiative. This paper will focus on five areas of issues, concerns, and needs related to transitional phases that impact the online faculty experience, online program development, and online teaching and learning.

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Parallel Processor

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Introduction:

Parallel programs can be modeled by undirected task graphs, $G_T(V_T, E_T)$, in which vertices, V_T=(1,2,. ? , N), denote the tasks of a program and correspond to data objects on which computations are to be performed. Edges, E_T, represent the data communication dependencies between those tasks and correspond to computation (calculation) dependencies among the data objects specified by the algorithm used. G_T can either be supplied by the user prior to program execution or be derived at runtime, and is referred to as the problem graph[Bok81;LeAg87],the task interconnection graph , or the computation graph . When performing computation in Parallel, G_T contains information about interprocessor communication . The parallel computer is represented by a graph Gp(Vp,Ep), which is referred to as the system graph , the processor interconnection graph [ChGe88; ErRS88], or the multiprocessor graph The vertices Vp = {1,2, . ? , N} refer to the processors, and the edges Ep refer to the physical interconnections (communication links). The problem of assigning the vertices of the task graph onto multiprocessors in a way that optimizes some performance metric, can be recognized as an optimization problem. In other words, the multiprocessor data allocation problem is a task-to-processor (many-to-one) mapping problem, M : V_T ? Vp, such that a cost function associated with the total paralleled execution time required for solving the problem is minimized. A solution that satisfies the minimization criterion is an optimal mapping. The problem of finding such an optimal mapping is known to be NP-complete. NP-complete problems are computationally very difficult. Thus, heuristic methods are generally employed to obtain satisfactory near-optimal solutions in reasonable time.

In parallel architectures, mapping leads to partitioning the problem graph into subgraphs allocated to the processors. A mapping configuration can be represented by Map[v]=M[i],where Map[v] is the array for v=0 to | V_T | - 1, and M[I] is the processor number in the range 0 to |Vp|-1,onto which task I is mapped. In this thesis, we present coarse grain parallel algorithms based on genetic algorithms and simulated annealing for the mapping problem. We implement the algorithms on the hypercube distributed-memory multicomputer and evaluate their performance.

2.2 Problem Formulation

We examine one important issue in parallel and distributed systems, task allocation or task assignment. Task allocation means a mapping of subsets of vertices of the problem graph to vertices in the system graph.

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Task allocation consists of partitioning the problem into subproblems, and assigning these tasks to the processors of the multicomputer so that an objective function associated with the total execution time required is minimized. The computational model considered here is that of the data paralleled algorithms.

The purpose of mapping data onto processors of the DMMs is the minimization of the parallel program run time. The run time depends on the characteristics of the parallel algorithm, the computational model, the problem size, and the underlying hardware architecture. To minimize the run time, the mapping objective is to maximize parallelism, to distribute workload evenly, and to minimize the communication cost in message passing among processors. An objective function (cost function) is defined to formalize the mapping objectives as a minimization process.

In this thesis, the focus is on the optimal mapping of a clustered collection of documents onto the multiprocessor nodes, namely the Muitiprocessor Document Allocation Problem. The problem was initially addressed in . The data allocation problem consists of mapping a subset of documents onto processing elements (PEs), attempting to satisfy criteria such that the average cluster diameter is kept to a minimum while providing for an even document distribution across the nodes. A variation of MDAP that we use in this work is formulated as follows.

Given:

A distributed-memory architecture with p nodes:

Nodes (PEs): $X = \{X_n \mid 0 = n = s - 1\}$;

Inter-node communication cost matrix: $M_{n,m}$, $(0 = n, m = s - 1)$;

A clustered document domain with d documents clustered into c clusters:

Documents: $D = \{D_l \mid 0 = l = d - 1\}$;

Clusters: $C = \{C_h \mid 0 = h = c - 1, C_h \subseteq D\}$;

Find:

An optimal allocation of the documents to the processors such that:

1. The number of documents at each node X_n is [d/s] or [d/s] – 1, $(0 = n = s - 1)$;
2. An objective function OF is minimized; OF estimates the total computational cost including the computation and communication load for a mapping configuration, and is defined as

$$OF = \sum_h (\sum_n W(X^h_n) + \beta \sum_n \sum_m C(X^h_{n,m}))$$

1

$W(X^h_n)$ is the com putation workload of node X_n, that is , $W(X^h_n) = \mathrm{Max}_n (X^h_n)$ for all n, $0 = n = s - 1$ and $0 = h = c - 1$, where X^h_n is the number of documents of cluster C_h allocated to node X_n. $C(X^h_{n,m})$ is the inter-node communication cost between node n and node m, specified as $C(X^h_{n,m}) = \mathrm{Max}(X^h_n M_{n,m})$. where $M_{n,m}$ is the system communication cost matrix with the two properties:

(1) $M_{n,m} = 0$ and (2) $M_{n,m} = M_{n,m}$; hence the matrix is symmetric. ß is a constant expressing the relative importance of communication with respect to computation and the machine-dependent ratio of the time to communicate one word one unit distance to the time for one computation operation.

To prove that MDAP is NP-complete, a polynomial-time reduction of the Quadratic Assignment Problem to the decision form (yes/no problem)of MDAP is provided.

Theorem 1. The data allocation problem is NP-complete.

Proof:

We rewrite the objective function of Eq.(2.1)as OF= ? $_h$ (a? $_n$W(X^h_n) +ß? $_n$? $_m$ $C(X^h_{n,m})$), where a is a constant representing the machine-dependent ratio of the time to communicate one word one unit distance to the time for one computation operation. We can assume that a = 0 andß= 1 without the loss of the generality. The data allocation problem is then reduced to the initial version of MDAP with Eq.(2.2), in which for the communication cost only, the function minimizes the summation of cluster diameters and it does not have the scaling factor. In other words, the old MDAP is a special case of the current version of MDAP and it has been proved in using the NP-complete binary quadratic assignment problem defined in Garey and Johnson . The data allocation problem generalizes the old MDAP. Therefore, the problem is NP-complete and this completes the proof.

A document allocation is defined by a permutation row P_k,$(0 = k = p - 1)$ and the mapping function f_k $(D_l) = j \bmod s$, where j is the index in $P_k$of document D_l .Each document allocation is evaluated with respect to its "goodness" of the allocation using the OF. The evaluation function E used in the original MDAP is expressed as

$$E(P_k) = \sum_{h=0}^{c-1} R_{kh}$$

Where R_{kh} is the cluster diameters for each cluster association list array C_h ,that is, $R_{kh} = \{M_{fk(Di),fk(Dj)} \mid 0 = I,j = d - 1$ and $D_l , D_j \in C_h\}$. Each document allocation is evaluated as the inverse of the sum of the cluster diameters it defines. The lower the sum, the better is the allocation. For the communication cost, E minimizes the computation cost and the communication cost are taken into account. The objective is not noly to minimize the communication cost but also to maximize the amount of parallelism.

2.3 Objective Function

A mapping is guided by some constraint that may be expressed by an objective function in a given application. The mapping can be different depending on the objective function. To formulate objective functions for the mapping problem, we consider the data parallel algorithms [HiSt86;Fox88a],as the computational model. Processors perform computations on their allocated tasks and then communicate with other processors to exchange necessary information in each iteration. The computing paradigm used is SPMD(Single Program Multiple Data)style on MIMD machines, where processors run the same program code but with different data. SPMD is a form of asynchronous data parallel computing. One can expect processors to coordinate with each other at synchronization points; every processor executes instructions at its own pace. SPMD is different from SIMD because processors are no longer doing the same

thing in lockstep; rather, they execute different instructions within the same program.

Objective functions to determine an optimal mapping can be categorized into two models: a minimax cost model and a total sum cost model. First, the minimax cost model can be expressed by

$$Of_{minimax} = \{Max_p\{T_e(p)+T_i(p)+T_c(p)\}\}$$

Where $T_e(p), T_i(p), T_c(p)$ are the computational execution time, the communication time, the idle time. respectively, for processor p. $T_c(p)$ is difficult to estimate accurately, because it is determined by synchronization delays during program executions. The maximum cost among all processors is minimized.

The minimax model is conceptually accurate. However, the use of the minimax approach is computationally expensive, because the computation of a new mapping requires the recomputation of the workload of all processors. To avoid these disadvantages, as a total sum cost for a mapping configuration, an approximate quadratic objective function Of_{sum} [MaFo91], is given as

$$OF_{sum} = \lambda^2 \sum_p N^2(P) + \mu(\frac{T_{comm}}{T_{calc}}) \sum_{p,q} H(p,q)$$

the where λ is amount of calculation per data element, N(p) is the number of elements allocated to processor p, μ is a constant scaling factor expressing the relative importance of communication with respect to calculation. The values of λ and μ are chosen according to a user defined ratio between the communication and computation terms of a presumably good mapping solution. (T_{comm}/T_{calc}) is a machine-dependent communication to calculation time ratio. H(p,q) is the Hamming distance between processors p and q.

OF_{sum} is attractive because of its locality property . Locality means that a change in the cost due to a change in the mapping of data objects to processors is determined by the remapped objects and the relevant processors only.

The choice of an objective function depends on not only the computational model employed but on the hardware and software components of the underlying machine architecture . Note that the choice is flexible and the parameters of the models chosen might need to be adjusted according to the particular setting. In fact, a characteristic of the genetic and annealing algorithms is their flexibility and adaptability to various classes of problems, models, and architectures. Our objective function of Eq. (2.1) was based on t total sum cost model. Although the OF does not precisely measure the total parallel execution time, we believe that it is reasonable for representing the approximate computation and communication requirements.

When considering computational complexity and performance of parallel algorithms, it is important to determine the speedup gained by multiple processors. That is , how much faster is the problem solved using P processors than when solved serially. The speedup Sp achieved by a parallel algorithm using P processors to solve a problem instance of size N is defined:

$$S_p(N) = \frac{T_1(N)}{T_p(N)}$$

2.4 Prior Related Work

We review previous mapping strategies. The mapping problem and some of its derivatives are NP-complete. Therefore, Heuristic algorithms that approximate optimal solutions have been developed. Some of these approaches dealt, in some manner, with the mapping of the problem graph onto a target architecture with a fixed interconnection topology. This problem is similar to the multiprocessor data allocation problem in which both problems must map a set of tasks/data onto the processors of a given system. However, the goals of the above works differ from our problem. We aim to minimize the total execution time of our allocation program by reducing the computation and communication cost.

Bokhari proposes a mapping scheme of distributed processors that uses two input adjacency matrices to represent the problem graph (the job modules and the intercommunications) onto the system graph (the processors and the interconnections),and then applies an exhaustive pairwise exchange of two job modules. The objective function used is to maximize graph cardinality – the number of matched edges in the problem that fall on the links on the system graph. The basic assumption in the scheme is that all the problem edges are considered identical, i.e., they have the same weight. However, more general problem graph may have different weights on edges.

Lee and Aggarwal extend Bokhari's approach by incorporating a set of objective functions that accurately quantify communication overhead into the problem. The optimality of mapping the problem graph onto the system graph is evaluated by the objective functions with a more representative communication overhead measure. They developed a mapping algorithm based on the objective functions, where they first make an initial assignment and then iteratively apply a pairwise exchange scheme to the initial assignment. The approach is still restrictive; it utilizes a fixed path routing scheme for the network traffic.

Bollinger and Midkiff formulate a two-phase mapping strategy to map a logical system onto a physical architecture using the simulated annealing algorithm, where the first phase, process annealing, assigns parallel processes onto processing nodes and the connection annealing phase schedules traffic connections on network data links so as to minimize interprocess communication conflicts. Objective functions which accurately quantify communication cost are derived to evaluate the quality of generated mapping. This work improved upon Lee and Aggarwal, in that it utilizes the information concerning the actual routing rules.

Mansour and Fox [MaFo91; MaFo92] have proposed sequential and parallel genetic algorithms for the task allocation problem in parallel computing. They introduce two design parameters related to objective functions. The first parameter is the degree of clustering of the data elements in a mapping configuration. A smaller amount of communication is likely to imply better data mapping and higher degree of clustering. The maximum degree of clustering would correspond to an optimal allocation. The second parameter is an estimate of the value of the optimal objective function. This estimate involves the problem size, the multicomputer size, and the scaling factor. Two parameters are utilized by a genetic algorithm for task allocation. Our data allocation problem closely resembles their problem. But, our problem formulation, the objective function used, and the underlying population structure model of parallel genetic algorithms are different from theirs.

Du and Maryanski attack a variation of the mapping problem. This variation concerns the allocation of data in a dynamically reconfigurable environment. The allocation algorithm employs a set of "benefit"

functions and a greedy search algorithm. The underlying execution architecture is based on a client/server model, a heterogeneous system. Although their problem resembles our problem, as the underlying architectural model significantly differs from our parallel execution environment, their assumptions are not relevant to our problem.

Woodside and Monforton generalize the multifit algorithm of Coffman a heuristic solution based on bin-packing for finding load-balanced allocations of independent tasks to multiprocessors. They introduce communication tasks into the algorithm which are to be allocated onto a bus-connected processors and present a static allocator which could be incorporated into an automated compiler for distributed systems. Their performance model of communications is like of Bokhari.

The Continuous Education Solution for a Country Wide Telecommunication Company

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Competition among companies has put up a challenge regarding training and development of human resources. In a country-wide company this challenge takes into account constant trainee traveling back and forth, so, generating costs. This paper presents a telecommunication development program that uses top of the available technology to broadcast synchronous classes, over a system with full motion images in real time. It uses a transmission rate as low as 2 Mbps, easily available almost everywhere, allowing training at remote sites with all of its advantages. The change in the education system that is proposed, is based on the fact that we could train more people with lower costs, without job displacement, without interrupting their work and regular routine activities, so achieving high efficiency.

On-line Learning and Teaching using a Telecommunication Network

1. Introduction

Actually there are many education methodologies based upon new technologies, but a lot of them without satisfactory results evidences. The lack of knowledge about new applied education technologies and methodologies is one of the main problems among professionals who are not being prepared to use those tools to be competitive in this new globalized world. Considering new education methods, associated to new technologies, one of the greatest challenges posted to instructors is keeping people motivated and using distance learning tools for actualization, focusing in the company business.

Thanks to technology, coupled with knowledge explosion in the information age, the notion of a traditional classroom with a group of students taught by a teacher is becoming a bit quaint.

A decade ago, there were the first attempts in distance learning as a corporate tool [5], which means using various methods to reach and teach people who are widely dispersed geographically.

The proposed change in the education system, is based on the fact that more people could be trained with lower costs, without job displacement, without interrupting their work and regular routine activities, so achieving a higher training result efficiency.

In practice, how is it possible ? What is the technology that can actually be counted on ? How is it implemented ? What methodology could be used for a Telecommunication Company environment ?

2. Methodology

This work refers to, as it is seen, the best-implemented solution until today in a Brazilian Telecommunication Company, that is seeking for continuous education for all of its employees scattered all over Brazilian ten states.

The methodology used for this system, counts on WEBTV resources, chat-room, a Teleducation system with full audio and video interactivity, which allows the participant a total interactive environment with the instructor, minimizing the discomfort caused by the non presential situation.

As a solution for those challenges it was sought one that could put together management instruments, top of technology, new distance learning methodologies, allowing organizing culture dissemination and valorization of the enterprise human capital.

PEN BrT, which is Brasil Telecom´s Extension Program is a technical and institutional knowledge-recycling program, focused in training employees on technical and administrative areas, wherever the professionals are, and they are spread out all over the Country.

The program issues were selected to provide a basic formation oriented to the Company's core business and the main departments internal processes, searching the improvement of quality service benchmarks.

According to the philosophy that the best Brasil Telecom's company business specialists are their own employees[6], they themselves conduct the classes. This methodology increased competitive advantage that derived from having a well-trained workforce that is up-to-date on the entire latest trends, collaborating with one another and sharing information throughout the company.

PEN BrT program is divided in modules, so the participant can choose issues that will bring him more professional development, without interfering in the follow up of other modules. With this proposal we expect to optimize the participants invested time, without disturbing their routine activities.

Classes are running on Wednesdays mornings (from 8:30 AM to 11:30 AM) at the auditorium located in the head office building. They are filmed, recorded and broadcasted through the auditorium's television system.

3. Technology

The Teleducation system implemented at Brasil Telecom uses an audio and video network exclusively for training [1]. It is based on compressed video using a MPEG-2 algorithm that allows showing VHS quality images, in real time and using a bandwidth equivalent to an E1 channel at 2Mbps. This low transmission rate allows using the public telecommunication network for this task. This bit rate is nowadays easily available and the backbone access can be made through a variety of means. It can be pointed out, as examples, coaxial cable, HDSL modems and twisted pair.

This connection is established without commuting need, so being cheaper than satellite. The features and possibilities of using this system in real time, as well as its interactivity, are its greatest advantage when compared to other training methods such as video tapes and solely computer based training (CBT).

The systems definitions that will be described bellow are some of pre-requisites considered for this system. Compressed signal must be used, since an analog signal requires too much bandwidth to be transmitted, so, being expensive.

This network requires the availability of one E1 link in a company building, where a reception point for the BrT television system is to be installed.

4. Distance Learning System

For those students who do not have a TV reception point nearby, it is possible to participate in classes through the WebTV system, since the web connection has a bandwidth larger than 300 KBPS with the main server so having an excellent audio and video quality. Through the WebTV class, students can watch the instructor, presentation slides, interacting with others participants and making questions through a chat-room, as shown in figure 2.

For distance learning classes, the interactivity with the instructor happens by e-mail, phone call and a chat-room provided in the course home page [2]. An instructor assistant receives questions and forward them to the instructor during classes.

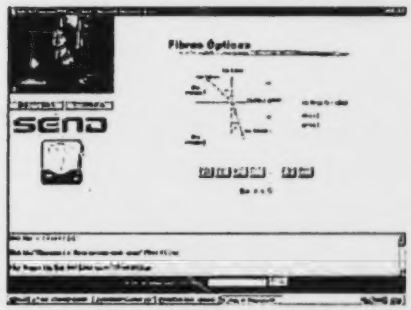

Figure.2 – WebTV Class

At the beginning of each class, presential participants receive the training material which was made by the instructor in advance. For distance online learning participants, the slides can be downloaded directly through the PEN home page – http://www.ade.crt.net.br/pen , for watching, printing, or online consulting during the class as well as afterwards.

Recorded classes remain stored at the Company's library for future references. Participants who could not watch a class can request the video tape through an on-line library service. The video will reach the participant desk in less than three days, for home watching. After this, he proceeds to the PEN home page to fill out the on-line evaluation and reaction forms for attendance registration in a training database [3]. Questions will be answered by e-mail or phone call directly by the instructor, who is a company employee too, during work time.

Distance learners fill out the registration participation form directly on the PEN site. There is a suggestion box, where the students can leave messages for the organizing team who manages the program.

5. Results

Until now 2.653 students participated in this program that began in September 10, 2000 and is supposed to end by June 6, 2001.

The results obtained up to this date can be considered satisfactory; some questions have been pointed out such as new technology equipment handling and a little delay pertaining to the information flow in this system. With some practice instructor and students were able to overcome these characteristics of communication.

Through the reaction and opinion evaluation and interviews with students and their managers, it was indicated that this teaching methodology has reached an efficiency of 82 percent considered through the question tasks applied under the PEN web page after classes and acceptance of 98 percent measured by a reaction evaluation .

The low cost associated to commuting and also, the fact that the employee does not leave his post to go to classes, contribute to validate the investment in this methodology.

6. Conclusions

Actually, the on-line learners can, not only access their studies from remote locations using multimedia, but they can also build online communities [4], swapping questions and answers with their tutors, and fellow students via e-mail and a chat-room.

This online learning methodology can add up to presential learning to build a successful knowledge management system and using technology to leverage the intellectual capital of the entire company, which in turn, leads to increased productivity, shorter time to access new knowledge to the company, and a superior competitive advantage.

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XML to XML through XML

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Abstract: When transforming an XML document for a given purpose, specifying the desired output format allows greater control over the transformation result than is possible using XSLT, especially when the format specification reflects the structure of the document to be produced. This also allows transformations to be transformed themselves, which may be useful to adapt them for application in different circumstances.

Introduction

As more and more on-line data are appearing in the form of XML documents the need is felt to have some mechanism to adapt such documents to different purposes. Such adaptations include the filtering of documents to extract relevant data from among data that do not serve the purpose at hand, e.g. to use these data in a given application, or to check whether the document satisfies certain search criteria and can be identified as relevant to some user need. It may also be necessary in some cases to change the contents of a document, e.g. by modifying some element or attribute values to satisfy certain constraints imposed by the user, the platform used or the author of the system using the documents. The best known use of transformations of XML, however, is to make them suitable for presentation, e.g. within a web browser. The XML transformation language XSL(T) (Clark, 1999) was originally developed specifically for this purpose.

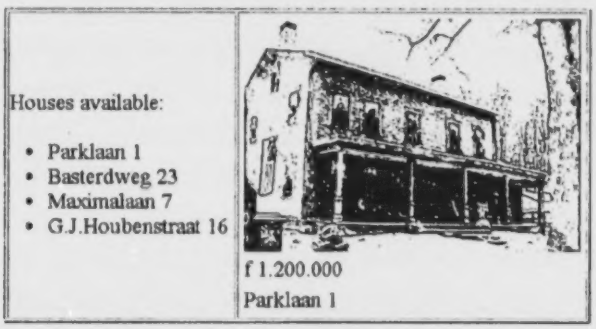

Figure 1: real estate example

As an example of the use of transformations of XML documents, consider a web site of a real estate agency (Fig. 1). It contains a number of HTML forms that allow users to formulate their wishes. For example, one form offers a selection of regions with houses for sale, and price ranges for the available houses. The values a user has selected are inserted as parameters into a query for data of suitable houses from the agency's database. This amounts to a transformation of some default query to serve this specific request. The query may result in all kinds of data, texts as well as pictures or video clips and sound bites. Not all platforms, however, are able to deal with all kinds of data, so the query will probably have to be modified (transformed) in accordance with the platform used. The execution of the query may be considered as a transformation on data residing in some database. Next, the retrieved data should be made accessible in a user friendly way. If the set of retrieved houses is large it could be presented as an index of houses to choose from, perhaps in the form of a panel of thumbnail images, each with a link to the data of the associated house. The data on the separate houses should be presented in a specific layout or be made accessible through specific navigation mechanisms. In HTML terms this implies the arrangement of data into tables, lists and links, using anchors for navigation. So for this relatively simple example already four kinds of document transformations are required.

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This paper shows XSLT to be less suitable for some of these transformations. It argues for the need of a special language, unlike XSLT, for their specification, and presents an outline of such a language as has been designed by our group. The paper also describes its use, for instance for the adaptation of transformation specifications to external requirements, and a means to translate the specifications in this language to XSLT transformations, which then may be performed in the usual way.

XML transformations

A transformation of an XML document implies different kinds of operations on the document in question. First, there is selection of data from the document. XSLT transformations perform these through traversal of the document, starting from the document root and descending into the different branches, and selection of the items required according to the expressions in the 'xsl:value-of' or 'xsl:copy-of' elements. Next, there is the reordering of the items found, e.g. into menus of house prices or locations with elements pointing to the data of the associated houses themselves. It is important to observe that since the order of evaluation of output expressions in XSLT is determined by the order in which the input is processed, there are output configurations that are hard to attain in that language. Finally new items may be added to the document, like captions to pictures or inferred data elements, e.g. for showing the distance from the house in question to the nearest shopping mall. In XSLT this may be done by inserting non-XSLT elements in the transformation specification, by using the XSLT 'xsl:element' or 'xsl:attribute' elements, or through 'xsl:value-of' elements with specific select expressions.

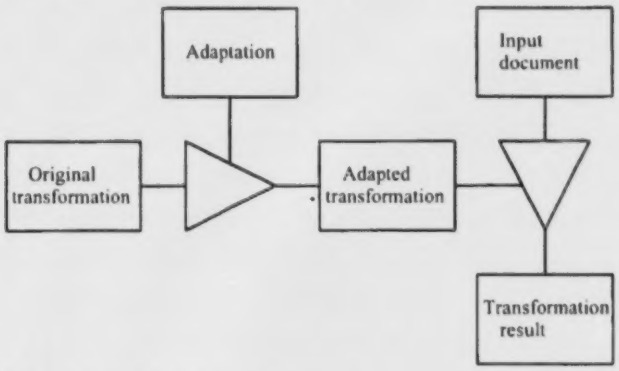

Figure 2: adaptation & transformation

In the course of our research for the HERA project (Houben & de Bra., 1997, Houben, 2000) the need was felt for the specification of such transformations in a form that reflected more of the structure of the documents in question than the currently used XSLT specifications do. Our aim was to allow transformations to be transformed themselves for different purposes (Fig. 2). For instance, the query mentioned in the real estate agency example needed to be adapted to the platform in question. Creating XSLT transformations to adapt XSLT transformations is not easy, because the structure of XSLT documents does not reflect the structure of the documents involved in the transformation and the adaptations may concern just this structure. So it would be preferable to have transformation specifications that reflect more of the document structure than XSLT transformations do. Converting such specifications to XSLT could be done through an XSLT transformation, as in (Jelliffe 2001), which needs to be written only once to serve every transformation one would need. So we decided to construct an XML language for transforming XML documents in the way described above, and an XSLT transformation to transform documents in this language to XSLT transformations. In this way it is relatively easy to modify queries or style sheets before using them for the task they were designed to perform.

The next section shows how such transformations may be specified in a way different from the XSLT way, using XML templates and parameter elements.

Templates and Parameters

A transformation takes an input document and produces an output document that contains items taken from the input document or items derived from such items. The input items are chosen on the basis of their position in the

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input document, their structure or their value. The output document has a prescribed structure that holds the selected or calculated items mentioned, which need not reflect the structure of the input document. The selection criteria of the input items and the structure and contents of the output document will be specified by templates with placeholders for parameters, and parameter expressions that specify values to be inserted for these placeholders. Templates are XML structures that reflect structures in the input document or in the output document, or they specify expressions used to calculate output items or conditions used in selection operations. Their elements are either elements as they appear in the documents in question or parameters that correspond to sub-templates, or elements from a specific language designed to specify the required operations. A template to be used in a query for the houses database mentioned above may look like:

```
<htl:template>
  <house>
    <price><htl:param name="PriceTag"></price>
    <street id="streetID"/>
    <houseNR id="numberID"/>
    <city><htl:param name="City"></city>
  </house>
</htl:template>
```

This template can be used to specify an element in the database that contains data on a single house. It has two parameters, called 'PriceTag' and 'City' respectively, that represent values, e.g. from a user form requesting data on certain houses. After execution of the query with these values inserted the addresses of the houses found will be available through references 'streetID' and 'numberID'. Normally a template will represent a set of XML elements that share some specific properties, but if it contains the root element of a document, directly or indirectly, it will correspond to a singleton element only.

In XSLT templates are used to control the traversal of the input document tree. Output is generated on the fly during the tree traversal process. As mentioned, this poses some limitations on the output structures to be generated as it is not possible to switch the insertion point of output data. Output structures, and the construction of an output tree using input document elements may however also be specified using templates. The elements from the input document are accessed in more or less random order in this case. Depending on the way the transformation is specified, the order in which transformation operations are performed will either depend on the given structure of an input document or on the specification of the structure of an output document. These different ways are shown in the following two sections.

Input driven specifications

The normal order in which the input document tree is traversed in the input driven case, as in XSLT transformations, is depth first, in document order. Of each element first the children are accessed, and the children of each these children in turn, etc., after which the next sibling in document order is processed. This order may be changed by specifying jumps in the evaluation order. All operations are defined with respect to the current context, which centres around the node which is associated with the current invocation of the template concerned. That means that parents, children, the preceding sibling and the following sibling of the current node, as well as its attributes are easily accessible. Elements from other parts of the tree are harder to access, but it is always possible to specify a path to an element starting from the document root. Templates only specify a local environment, i.e. an element of a certain type, possibly with a parent and one or more children or attributes. Tree traversal means switching from one template to another, either in the default order, as described above, or following explicitly specified context switches. The template context, i.e. the 'match' attribute of the 'xsl:template' element, is specified using XPath expressions (Clark & DeRose, 1999).

Output operations are local to a specific template, and thus are processed in the order in which the templates are processed. Although clever interleaving of context switches and output operations, and use of variables to store intermediate output substructures may somewhat alleviate this problem, there are limits to the possibilities of building new structures using elements of a specific input document in this way. And as there is not a one-to-one relationship between the elements of the document type and the elements of the transformation specification it is hard to adapt a given transformation specification to a specific purpose by a suitable transformation of a XSLT specification:

- The templates only represent a (small) part of the full input tree, and there are many different ways to specify a specific kind of transformation of a given type of document.

- The (sub)structure specifications are in the form of (XPath) expressions of which the elements are not easily accessible and the structure is not isomorphic to the structures specified.

Output driven specifications

The specification formalism proposed in this paper uses XML trees to specify the structure of the output document. This is comparable to what XML query languages like XQuery (Chamberlin et.al., 2001) do, only the queries in such a language are not isomorphic to the query output. The schema defining the output will have one template containing the root of the output document and any number of templates for other parts. The output document is built in a hierarchical way, starting from a main template of which the parameters may represent other templates, which in turn may invoke other templates, etc. It is thus built in template order, which may differ from the order indicated by the relations among the elements of the result tree. The elements from the input document that are used in the output are accessed in a context-independent way, in the order in which the expressions that contain them occur in the output template hierarchy. An atomic term in an output expression may bind to any number of input elements, depending on the position within the input document as indicated in the expression, its relations to other elements or its value. For instance, if the input file mentioned in the real estate example contained several houses that satisfy the criteria of the query, a pointer to the price element contained within the element representing the retrieved houses would indicate not one, but a number of prices.

As multiple elements of a given type may result from a single element in an input specification, multiple elements may also appear in the output where the specification contains only one element. A query for a house in a given city within a given price range may deliver a number of elements, each one describing a single house. So for each element in an output specification that may result in multiple instances an applications designer should supply some access structure which allows each of the instances to be displayed, either alongside each other or alternatively, e.g. using indexes or guided tours.

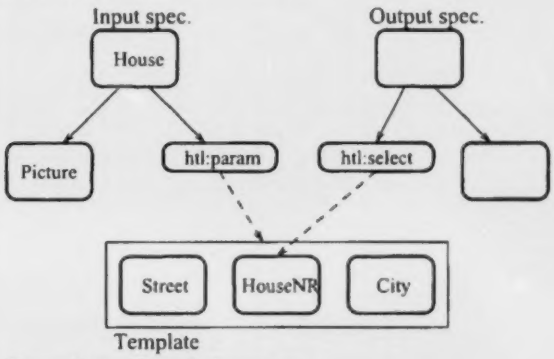

Figure 3: templates & parameters

Transformations specified in this way allow full freedom in specifying the output format while still permitting full access to all parts of the input (Fig. 3). The price to be paid is the extra specification of the input, but this needs to be limited only to those parts that will actually be used in the output, as far as they are readily identifiable in the input document. Where that is not the case, as for instance where a file contains data on both CDs and books, each with their own price elements, and you are only interested in book prices, you need to specify as much of its environment as needed to identify the element in its specific role.

Transformation specifics

The basic operations of a general purpose transformation mechanism are filtering, selection, reordering and addition. Filtering means selection of elements, to be used in the generation of the output document, from the input document(s), according to certain criteria. These criteria are specified in the form of a schema that describes the structure of the data required and in which constraints are given for their values. The input specification will thus specify which part of the input documents is relevant for the transformation concerned and exclude the irrelevant data. The filtered elements and attributes should then be put in a different framework. We would like to have them in a different order, with added information like specific captions for pictures or

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columns in tables, and values calculated from the data retrieved. In this stage the new framework is specified, with selections which refer to the input schema for the values to be inserted or calculated. Transformation specifications in HTL (for "HERA Transformation Language") will thus consist of two parts corresponding to these stages. Both parts will use an XML representation with a structure comparable to that of the documents concerned. Input specification and transform specification will each consist of two kinds of elements: elements from the specification language that indicate certain constraints or operations, and elements that represent elements in the input or in the output documents.

The set of templates used to specify the input does not need to represent the document completely, it should only allow the parts used in the output to be accessed. So e.g. the document root will not necessarily be represented within some template. Attribute values or element contents may consist of values or expressions that represent constraints on the values that appear in the input. This is the way to specify selections from the available data. Elements that may be accessed by the output part should be identified by an explicit 'ID' attribute. Tag names of elements identifying the input part, the output part, the parameters, the links and the expressions will all be from the 'htl' name space, the other element names reflect the names as they appear in the respective documents. So for our real estate agency example a definition of an input filter may look like:

```
<doc>
  <house ID="houseID">
    <price>
      <htl:from>50000</htl:from>
      <htl:to>100000</htl:to>
    </price>
    <htl:param IDREF="addressID" />
    <picture />
  </house>
</doc>
.............
<htl:template ID="addressID">
  <street /> <houseNr />
  <city />
</htl:template>
```

This input specification contains one template for the address of the house, which may be expanded within the house element. It selects houses in a price range from $ 50,000 to $ 100,000.

The output part specifies the reordering of data from the input document and the addition of new items. It contains another set of templates, one of which should contain the root element of the document to be generated, as no document can be generated without a root. One template should be identified as the main template, the template from which to start generating the output tree. Expression templates will indicate output data to be generated. IDs identify such templates or those to be substituted for parameter tags.

There will be links from the output part to the input part, but not the other way around. The links will be based in 'htl:select' tags, which will have an 'IDREF' attribute pointing to some other element. The 'htl:select' elements allow each member of a set of selected input elements to be accessed separately. The example shows what such a transformation specification may look like. Consider the real estate application mentioned before, where we would like to query a (possible large) database of houses to find those within the price range specified in the input part. The result of the query should be presented in HTML with for each house one paragraph containing its picture, its price and the city where it is located. Using the input specification shown above, the output specification of this query could be formulated as follows:

```
<htl:output>
    ......
  <body>
    <htl:select IDREF="houseID">
      <p> <htl:value-of><picture/></htl:value-of>
      price: <htl:value-of><price/></htl:value-of>
      city: <htl:value-of><city/></htl:value-of>
      </p>
    </htl:select>
  </body>
  ......
</htl:output>
```

Implementation issues

As XSLT engines like Xalan (Xalan 2000) are readily available and are reasonably efficient we use such an engine to perform the actual transformations. Therefore the specifications need to be converted to XSLT documents. For this purpose a XSLT transformation has been defined. So in order to execute a query like the one shown above it will first be transformed using XSLT, and the resulting XSLT transformation will then be applied to the input file. This transformation may contain one XSLT template for each output template. These are named templates, to be invoked at the position at which the template parameter occurs within the output specification. Where input elements have a fixed position within the document tree they will be accessed through absolute paths that all start at the input document root. Otherwise the XPath expression that identifies them will start with a double slash ('//'), indicating they may be found anywhere in the document tree.

When select templates are translated into XPath expressions, the element that the 'htl:select' element points to has to become the current element. That means that its ancestors, as far as they appear in the template, should be part of the path, and the descendants should appear in the additional conditions to be fulfilled by the element from the input document. So the example template of the input specification above, when used as shown above in the 'htl:select' element from the output specification example, would be translated to the XPath expression:

'/doc/house[price>50000 and price<100000 and picture and street and city]'

Conclusion

The method of specifying transformations of XML documents described in this paper defines these documents in a way that directly reflects their structure. The specifications are based on the required structure of the output documents, allowing full freedom in defining their layout, independent of the contents of the input documents. As the format of the specification closely resembles the format of the documents to be used and produced the complexity of transforming of the specifications themselves, e.g. to adapt them to specific needs, is comparable to the transformation of the documents proper. Because the actual transformations may be done by one of the many available XSLT engines they can be performed rather efficiently.

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WebNet 2001 Conference
Short Paper Proposal

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Title: Web-Enhanced Teaching: Strategies for course management systems at a private residential undergraduate college.

Background

The reasons given for pursuing distributed and distance learning strategies and installing course management systems often involve discussions of budgets and economies of scale. However, the same technologies can work to add value to the educational experience at a residential undergraduate institution where faculty employ strategies to enhance their students' classroom experience with web enhancements.

Web-Enhancement Benefits

1. Increased Communication
   Opportunities for frequent and personal interaction with the faculty is one of the reasons students sometimes elect to attend a smaller undergraduate institution. The demands of conflicting schedules often work to inhibit this contact. Faculty can help to overcome the time crunch with web-enhanced strategies. Discussion forums, message centers, and live chat sessions can provide students with increased access to professors.

2. Accommodates Multiple Communication Forms
   Many college classes engage students in other forms of expression and communication than the traditional typewritten research paper or essay. Enhancing a college course with web technologies allow students to communicate with video, audio, and other multimedia formats.

3. Forum for Scholarly Student Interaction
   One of the challenges many faculty face is the task of getting students to consider their ideas and work in the context of a greater community. Web-enhanced courses provide fora (with varying amounts of protection or guidance from the professors depending on the situation and the technologies) where students can present their theories and observations and receive peer review and criticism. The experience can serve as a model for later scholarly communication, collaboration, and engagement.

4. Extends the Classroom
   All professors struggle with the constraints of time and space. Web-enhanced classes have the benefit of extending the interaction beyond the time limits and

locations that classroom teaching bears.

5. Increases Access to Rare and Fragile Materials
   This concept is perhaps one of the most obvious and commonly imagined uses of web technology in teaching. Virtual museums, document collections, and other archival repositories (including data) can become part of lessons, projects, and assignments.

6. Provides Opportunities for New Models of Mentoring and Advising
   Students can develop more insight and understanding of the work of scholarship when they have access to the professor and his or her own teaching materials.

Web-Enhanced Strategies

While the benefits may or may not be obvious to those who facilitate learning and/or technology, the strategies to accomplish those benefits are not always obvious.

1. Using Faculty Research
   Many students experience a disconnect between the reality of the classroom experience and the personal research that many faculty produce. One of the most effective strategies for encouraging faculty to invest in creating a web-enhanced course and getting a student to engage with course material is to use the personal research of the faculty for course instruction. Students begin to understand what faculty do as researchers. Class assignments are interesting and personally engaging for both students and professors. Opportunities for advising and mentoring increase as students experience the real world work of their professors.
   [I will show several examples – Language acquisition course, Performance analysis course, Statistical sampling course.]

2. Focus on Experiential Learning
   The best web-enhanced courses encourage the students to engage, analyze, study, research, observe, theorize, react, and interact with whatever the course topic has to offer as data. This strategy, while related to the previous one, focuses more on outcome than content. However, the most successful outcome will use the content provided from the professors' own projects and experience.

Web-Enhanced Costs

While this paper is not about the problems of creating a web-enhanced course, I do plan to mention at least the following.

1. Imagination
2. Pedagogical Organization
3. Time
4. Technical Ability
5. Institutional Support and Infrastructure

E-LEARNING: AN OVERVIEW OF NEXT-GENERATION INTERNET BASED DISTANCE LEARNING SYSTEMS.

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ABSTRACT:

Many firms today are investing in Internet based distance learning systems or e-learning systems due to the tremendous time constrains both on the employees and the firm. It is estimated that the portion of e-learning market devoted to IT content training only is expected to grow from $1.7 billion in 2000 to about $5.3 billion in 2003 (Smalley-Bowern 2000). Understanding today's Internet based distance learning systems for effective and successful implementations is in growing interest both for researchers and practitioners. Initially, this paper attempt to clarify the differences among the first- and second-generation Internet based Distance Learning systems. A closer look is given to the key players in this area: the student/learner, the professor/faculty/teacher/facilitator, and the administrators/IT administrators. Additionally, this paper will build an argument for the future of next generation distance learning systems based upon the current issues concerning Internet based Distance Learning and Internet based Distance Learning systems. It is assumed that in the next few years, broadband Internet access and the use of Internet Appliances will increase even more the demand for Internet based degrees with more emphasis on real time collaboration as the key for learning success, especially Internet based MBA degrees. This paper will prepare the ground for future research that seek scientific evidence for enhanced students learning experience from combination of the first- and second-generation systems. It is my impression that in the near future students will pay premium to seat in conventional classrooms and interact with professors and classmates, as opposed today, that students asked to pay premium to attend Internet based Distance Learning courses.

E-LEARNING: AN OVERVIEW OF NEXT-GENERATION INTERNET BASED DISTANCE LEARNING SYSTEMS.

INTRODUCTION:

It is said that the twentieth century and especially the second half of this century changed the world forever. The use of technology and information systems as a tool becomes more and more a necessity rather than a luxury or recreation. The explosive growth of technology and information systems both in homes and in firms has motivated individuals to educate and expose themselves to a variety of technologies. In the last decade of the twentieth century and the beginning of the twenty first century the Internet and other information systems provide a tool for individuals and firms to gather information, make informed decisions and conduct business over great distances that could not have been achieved without these technologies.

Many firms are spending millions of dollars on new technologies. Most expenditures are related to information systems for the primary purpose of enhancing their business processes thus increasing productivity. With very low unemployment rate and relatively high demand for qualified IT personnel in the US, firms are straggling to retain their employees. On the other hand, employees are more and more stressed for time both in their workplace and at home due to pace of the "fast economy" and the use of technology and in formation systems. Furthermore, with the Internet access at offices, at homes, on cell phones, or in cars some employees are virtually twenty-four hours a day on the job. Consequently, employees are seeking some personal rewards from firms and from their workplace. Many employees desire to improve themselves and expand their knowledge while working vicious hours. They feel that they have to keep up with the technology, due to many upgrades, changes and new systems that they have to catch-up and stay abreast.

One of the methods firms are rewarding their employees includes providing training either within the firm in a corporate university settings (i.e. Oracle, Microsoft, Cisco, and many more) or outside the firm in a traditional university settings. Due to the tremendous time constrains both on the employees and the firm, many firms are investing in Internet based distance learning systems or e-learning systems. It is estimated that the portion of the e-learning market devoted to IT content only is expected to grow from $1.7 billion in 2000 to about $5.3 billion in 2003 (Smalley-Bowern 2000). This tremendous growth is mainly due to the great flexibility in delivery of most e-learning programs. Having the learning experience as a self-pace, customized, asynchronous (non-real time) and even modular can add up to the flexibility of e-learning programs. New emerging technologies enable synchronous (real time) content delivery over the Internet. These tools are changing the ways most e-learning have been viewed in the past few years.

It was said that the key for the learning experience is not the content, but rather the interaction of real situations in real time (Goldwasser 2000). The idea of learning by doing or interacting with classmates rather than learning by reading is not new to the business community. In 1957 the American Management Association first suggested that learning business situation is much more efficient with simulations and case studies than reading the concepts. This is why I believe e-learning will heavily include the traditional instructor-led teaching but the medium will be online where students access from all over the world, rather than traditionally, one physical location on campus.

Since the late 1980s there is a dramatic explosion of corporate universities. In late 1980s there were about handful corporate universities, while in the mid 1990s there were more than 400 corporate universities, and it is estimated that in the late 1990s there were more than 1600 corporate universities (Moore 1997; Suzik 1999). Some put at fault of this tremendous growth in corporate universities at the traditional business schools for not supplying MBAs with needed training which they can apply the next day in their job, rather provide them with learning tools. Many corporations, in particular American corporations, acknowledged that one of the major factors in sustaining the competitive advantage is the ability to learn faster than competitors. Today some corporations have a chief learning officer (CLO) who has a strategic and leadership position within the executive management level. This exemplifies the importance that learning and training takes in the firm.

In the past two decades there was a growing trend to deliver education, primarily business and management education, to remote students wherever they are outside the traditional university campus. In the late 1980s Canadian business schools invested enormous amount of time and resources to develop learning programs for a distance delivery. US business schools quickly followed them with some top business schools like Duke and Michigan implementing Internet based distance learning programs. As the use of the Internet increased, during the second half of the 1990s, many other US

universities headed by their business schools implemented Internet based distance learning programs almost all include one version or another of MBA program.

It is estimated that the so called "cash cow" of the business schools, executive MBA program, will be in growing competition with the corporate university in the following years (Davids-Landau 2000). Many youngsters today graduating from high school, skip traditional college education and go directly to corporate university, or other corporate certificate program, i.e. Microsoft's "Microsoft Certified System Engineer" or "Microsoft Certified System Designer". This, they believe, may help them land on a well paying job and a prospective career path, without traditional college degree.

As indicated above, competition and explosive growth in the use of the Internet as a learning tool both in corporate and in traditional universities will continue in the future. Therefore, understanding of today's Internet based distance learning systems for effective and successful implementations is the growing interests for both the researchers and practitioners. I believe that the overall reliance on instructor-led teaching will remain similar in the next several years; it's the medium of delivery that will change.

I will begin this paper with a brief history of distance education, highlighting today's Internet based distance education and continuing with the clarification of the first and second generation systems. Furthermore, I will explore the major players playing in the academic domain of e-learning and their evolution: the student/learner, the professor/faculty/teacher /facilitator, and the administrators/IT administrators.

BRIEF HISTORY OF DISTANCE EDUCATION:

The history of distance education can be traced back to the early form of education by correspondence via regular mail in the late 1800s (Burke and Slavin 2000). The first form of distance education relied heavily on a self-study student driven learning, mainly out of printed material that was mailed to the student in a remote location. As technology progressed, it gained an essential roll in the "conventional" classroom. Educators and administrators began to seek its use for distance education purposes. The early days of technology in the classroom included photo slides and motion pictures. Later on it evolved into films during the late 1910s early 1920s. As the cost and the development time of these new technologies were tremendous many academic institutions seeking to provide distance education had to continue to relay on education by correspondence (Barker et al. 1989).

In the 1930s radio transmission of educational studies encountered a failed trial, again most likely due to similar reasons of cost and development time. At the same time in 1932, seven years before commercial television was introduced to the American market, the State University of Iowa has began experimenting with television transmission of instructional courses. Due to World War II this early pick of enhanced technological advancements use in distance educations had to be put on hold, but these early experimental days signaled the potential use of cutting-edge technology in distance education (Wright 1991). It appears that the televised distance education was here for good. The following five decades, and even today, courses have been broadcasted via live television transmission or even pre-recorded for ease of use and flexibility for the students.

As newly and emerging technologies played a major roll in every step of the evolution of distance education, it is not surprising that the emergence of the Internet as a new medium of communication revolutionized the distance education field. During the 1990s there was an enormous progress in the use of the Internet for delivery of instructional education. Many higher education administrators believed that distance education delivered over the Internet would be the ultimate haven for them, providing both large possibilities to reach students at remote locations, across continents or the world and compete with other universities. At the same time, it would increase student enrolments and maintain the same limited physical resources available on-campus. At a period of declining student enrollments, aging student population, declining recruitment of new instructors, and reduced level of federal, state, and local funding, some higher education administrators are even under the impression that class size is not a limiting factor any longer as there are no physical restrictions on the number of students that can be taught via the Internet by an individual instructor.

Apparently these beliefs were proven wrong and Internet based distance education has its own limitations. Most of today's Internet based courses are concentrated around the benefit of flexible education, self-study student driven learning "anytime", and "anywhere". In the past few years many universities have been investing heavily in development of partial or full Internet degree programs. Most of these Internet based distance education programs were designed with the "self-study student driven" learning model. Some universities subcontracted with non-academic IT companies to develop high quality programs in "just-in-time" mode or with 24×7 availability mode while at the same time create a rich instructional material, including slides, audios, videos, animations or illustrated figures, interactive learning games, web links, and collaboration tools (Burke and Slavin 2000).

INTERNET BASED DISTANCE EDUCATION:

Some researchers divide current Internet based distance education systems into two generations: "asynchronous mode" and "synchronous mode". The division is based mainly on the mode with which the lecture is enabled via the interface between the professor and students. It is also considering the mode at which technology enables the communication between the student-and-the-professor and the-student-and-classmates.

The first generation of Internet based distance education systems are the "asynchronous mode" which consist heavily from a "student driven learning" or "learning on demand" type of education (See figure 1 for a sample of WebCT course interface). The word "asynchronous" in the sense of "non real-time", is referred to the type of education that the professor is not providing any live or real-time lecture via the Internet. The course content or learning material is developed ahead of time and is available to the student in the form of slides, audios, videos, animations or illustrated figures, web links, and interactive learning games and collaboration tools. The student is initiating the learning process by logging into a secured website from any corner of the world via the Internet. The students browse the content at their own pace, post and read messages to/from a bulletin board or newsgroups, upload homework assignments for the professor's or TA's review, and take quizzes during allocated time. Most first generation Internet based distance education courses are a substantial extension of regular classroom material curriculum tweaked and converted for delivery via the Internet (Zielinski 2000a). It is well established in the literature (Wegner et al, 1999), and I found similar evidence in a data collected over three years 1998 to 2000 in undergraduate business students, that the learning outcomes of first generation Internet based distance learning courses are at least as good as in-class ones. The analysis, results and conclusions of this data are subject for another paper, which I do not plan to address in this paper.

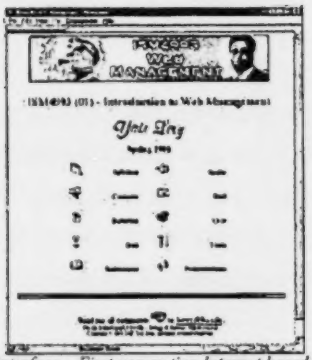

Figure 1. WebCT course interface – First generation Internet based distance education system

A new breed of Internet based distance education system is emerging due to some new innovations in Internet technologies mainly in the area of voice over Internet protocol (VoIP) and the increase popularit y of high speed Internet connection at residential locations (See figure 2 for a sample of a Centra Symposium interface). The second generation Internet based distance education systems are the "synchronous mode". The word "synchronous" in the sense of "real time" is referred to the type of education that the professor is delivering real-time lecture. Although the so-called "asynchronous" courses contain some types of synchronous communication tools such as the chat or the whiteboard, the mode of lecture and course content delivery is still non-live. In a synchronous environment of Internet based distance education the course content or learning material is similarly to be developed a head of time mainly in the form of slides, animations or illustrated figures, web links demonstration that will be available to the student during the live session.

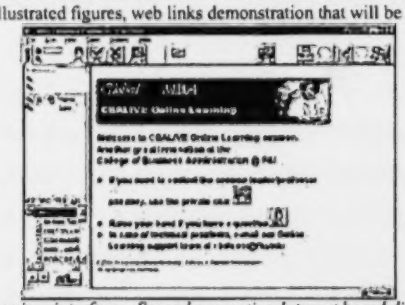

Figure 2. Centra Symposium interface – Second generation Internet based distance education system

While in the asynchronous mode of learning, the student is initiating the learning process, in the synchronous mode of learning, the professor is the one initiating the learning process pertaining primarily to the lecture and course content delivery portion only. The professor schedules a time for live session, the students are logging into a secured website from any corner of the world via the Internet and accessing a "virtual classroom" environment, where the other classmates and the professor in synchronous environment are connected but physically separated from one another. While time difference is an issue that must be addresses, it is possible to deliver real-time lectures over synchronous Internet based tools. Using this "virtual classroom" environment the professor can lecture over the Internet, the students can see the slides and follow his/her slide demonstration and simultaneously hear the professor's voice. Students can also interact with classmates and the professor in real time.

Most "virtual classroom" environment will allow the professors to function and deliver their lectures similarly to delivery of lecture in conventional classroom setting or computer lab on campus equipped with computer and Internet access. In this mode, the professor and students are physically located in separate locations. Students can still see the demonstration and hear the professor's voice as they are in a conventional classroom. Features as slides show, application demonstration, web demonstrations, breakout rooms, two way audio between the professor and students, whiteboard, and instant surveys are part of most "virtual classroom" environment tools available in the market today. Some of these tools will utilize the telephone system to deliver the audio and the Internet to deliver the data, while other tools use the Internet infrastructure for both the audio and the data delivery.

As most instructional courses consist of not only classroom activities and lectures, but also include "off-class" discussions, homework assignment or other "off-class" activities which can greatly be achieved via the "asynchronous mode", some innovative educational institutions have started to integrate both the first and the second generation Internet based distance education systems (See figure 3 for a sample of WebCT course interface with a link to the "Live Session" Centra Symposium interface). By integrating the two systems, students are required to attend live lectures via the Internet and at later time submit assignments via a course website, communicate, collaborate, and contribute to general "off-class" time discussions with classmates and the course professor, and read the course notes prior to the live sessions. In the next decade it is predicted that technological advances may make Internet based distance education much more effective and financially attractive both for universities and students/consumers.

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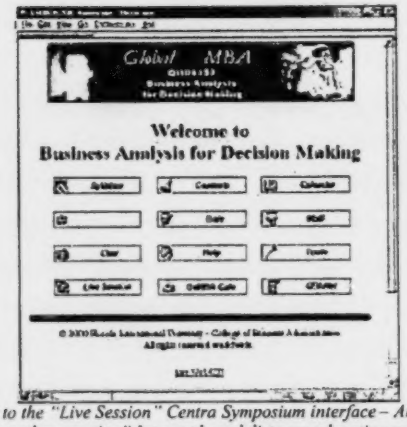

Figure 3. WebCT course interface with a link to the "Live Session" Centra Symposium interface – An integration of both the "first generation" and "second generation" Internet based distance education systems

Technological advances and telecommunication improvements will dramatically increase the bandwidth in the so-called "last-mile" of Internet access. The "last-mile" is a coined nickname for the telecommunication connection between the residential locations and the closest local telecommunication company's main switch. The last-mile has been always the bottleneck of Internet access for residential customers (Burke and Slavin 2000). Consequently, the use of voice over Internet protocol (VoIP) for Internet based distance education will soar. Apparently if the bandwidth of the last-mile Internet access will increase, software technology will quickly catch-up and come with new innovations to "fill" the bandwidth up. It is already available in some of the new versions of the synchronous "virtual classroom" environment tools, which enable streaming of video images of the individual who is talking whether it's the professor or a student. Today the quality of the video transmission over standard modem connection is relatively poor, and even companies with high bandwidth are having some difficulties accommodating the demand of simultaneous video and data over their network. Due to these technological constrains, at the moment, this new technology is not widely used, but it will definitely be the future path of the next generation Internet based distance education systems.

Some instructional media developers claim, as the old saying, that "a picture worth a thousand words"... a video of the professor will make the student more motivated and involved in the lecture while providing the "feel" of a conventional classroom environment.

In summary, Internet based distance education will not completely eliminate the conventional classroom learning. There will be always students that prefer seating in a classroom and experiencing conventional classroom lecture rather than an Internet based classroom experience. However, as the demand for lifelong learning, technological innovations, and individuals' technological proficiency increases the use of distance education over the Internet is expected to multiply in the next decade. Nowadays most universities and higher education institutions charge premium from students taking Internet based distance education courses, it is predicted that in the next decade the coin will flip and students will have to pay premium to seat in a conventional classroom. The combination of the first generation "asynchronous" and the second generation "synchronous" Internet based distance education systems will intensify in the next few years, allowing educational institutions to reach new and remote markets, while at the same time increase dramatically the competition among educational institutions around the world.

THE STUDENT, LEARNER:

There are two kinds of students' thoughts about Internet based distance education. The first one will experience this type of education and will appreciate the value of its flexibility. While the other will not seek to experience Internet based distance education, as it is absolutely impossible for that type of student to devote time for self-learning education. Unless the learning mode is very structured and requires them to attend classes on designated times, they will simply not be able to catch-up and most likely fall behind (Carswell et al. 1999).

The students who value the flexibility of Internet based distance education should posses a higher level of self-time management and discipline, especially in the first generation type of Internet based distance education systems. Some even claim that many students participating in this type of learning have less hectic lives, meaning young and single (Zielinski 2000b). They greatly value the ability to seat in their home office and access the asynchronous class material while wearing only bathrobes, rather than drive to campus during rush hours, fight traffic and spend forty-five minutes begging for a parking spot on campus.

Students whose lives are much more hectic, perhaps married with kids or working mothers or single parents, will be less tolerant toward the first generation of Internet based distance education, mainly due to the fact that their days are full with activities, and when their kids finally fall a sleep, they are so exhausted that it is virtually impossible for them to devote time and concentrate on a self-pace learning course.

Overall individuals today, no matter their lifestyle, are increasingly constrained by time and are virtually twenty-four hours a day on the job. Consequently devoting time for their self-pace course study is a low priority. In one study, 95% of the respondents identify time constraints as a "very important" or "somewhat important" reason for attending Internet based distance learning courses. Additional researchers also supported these findings (Thompson and McGrath 1999).

Another factor affecting students participating in Internet based distance education courses is the challenges of learning via the Internet, especially with the first generation types. The lack of clear explicit instructions of the coursework requirements including the amount of reading, assignments and bulletin board postings, discourage many students taking Internet based courses. This obstacle is clearly due to weak instructional development and definition of course content and activities related to Internet delivery. This problem can be addressed by a relatively low compensation to professors and the lack of adequate instructional development support and training on Internet based courses and distance learning course environment in general. Poor design of course content, and ambiguous instructions and the inconsistency of "look and feel" of some courses are the main concern of Internet based distance learning students. Some universities require their professors to develop their own courses while not providing the support needed, resulting in most cases in low-quality course presentation with tremendous amount of boring text, non-stimulating images and inadequate course content. Therefore, students prefer to read the textbook assigned to the course instead of learning the course content via the Internet (Carswell et al. 1999).

For Internet course lectures that are delivered via the second-generation systems, students have a better framework and are required to attend lectures via the Internet at designated time.

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Another common problem with students' learning over the Internet is attributed to the lack of technical knowledge about the use of common Internet applications and communication tools over the web. It is expected that in the next decade students will feel more natural comfortable with learning via the Internet, as their daily use of the Internet will be a routine part of their daily lives as much as the phone system is known for many people today. There are still many students today who are registered for Internet based distance learning courses even though their technical skills are not adequate to attend such courses. Students often get overwhelmed with the technology and fall behind their learning pace due to lack of such skills and support. This fact was also collected in the data that I plan to fully analyze and present in another paper. Most institutions will claim that they require students to posses some minimum technical skills but almost none actually assess and enforce it. Added to this is the fact that Internet technologies and Internet tools are rapidly changing, making the learning tools much more advanced, hence more complicated for students with limited knowledge and experience with the basic tools to grasp. This problem is more significant in the introduction of second generation systems. As second generation Internet based distance learning systems become the "bleeding edge" of today's technology, by challenging many technological glitches, students without basic technological knowledge will quickly get frustrated and are likely to drop the course or even drop out of the program, while students with fair basic technological knowledge will better tolerate this new technology, accept the great benefits of using it, and most likely to be less frustrated with the system (Carswell 1999).

Another group of students who is more likely to choose Internet base distance education is international students. These students are living permanently outside the US and wish to study and earn a degree from an American university. Most universities in the US routinely help international students come to the US acquire a visa and study on-campus, while facing the challenge of sponsorship employment due to the limitation of a student visa and the departure from their families back home for the duration of their studies. By using Internet base distance education, international students can stay in their home countries and earn an American degree. As class communication in an Internet based course is vital, in some cases students' respond to general class discussion will be more affluent in asynchronous communication tools than in synchronous. International students in particular, who speak English as their second language, will more likely favor the asynchronous type of communication tools and will feel more comfortable using it where they can employ a grammar and spelling checker prior to posting the messages online, rather than shy away from a synchronous or live audio session.

In summary, today's fast-track economy encourages many individuals to pursue learning over the Internet due to its great flexibility in time and easy access for traveling and working professionals. On the other hand, students who are less self-motivated and possess weak time management will most likely procrastinate and fall behind. As technology improves, the last-mile Internet access will advance to high-speed access, students' technical skills will improve, integrated Internet based distance education systems with both the first and the second generation systems will be a great value for many working professionals, international students and individuals with low time availability seeking advance education and new degrees.

THEPROFESSOR, FACULTY MEMBER, INSTRUCTOR, FACILITATOR:

In the past several hundred years, almost all instructional sessions where based on an individual(s), who present, talk, or lecture to a group of other individuals. As such, all students in a sense know what is the roll of the professor (I will use the terminology "professor", although it can clearly be referred also to an "instructor", a "lecturer", a "faculty member", or a group "facilitator"). As all professors were students in traditional classes before becoming professors, it is obvious that they know the roll of the professor and how to lecture and teach in conventional classroom settings.

In Internet based distance education one cannot expect professors, who never experienced being students in distance education courses, to have the same awareness when teaching such courses. Some educational institutions require their distance learning faculty to attend an Internet based distance education for the duration of one semester, prior to developing or teaching such a course. Evidently, due to professors' lack of time, low compensation, and pressure from administrators, most educational institutions press their professors to teach an Internet based course with very limited support and guidance from instructional media developers regarding pedagogical issues of learning over the Internet (Almeda and Rose 2000).

Above all, administrators demand more and more of their teaching time for special programs: weekend MBA, earning MBA, part-time MBA, executive MBA, online MBA, MBA abroad, and many others, in an effort to increase the enrolment numbers. With the use of Internet based distance learning systems, both first and second generation systems, institutions can reach new and remote markets and compete with other educational institutions, making the increase in demand for professors' time even bigger. Clearly the compensation for these over-load courses must justify spending nights developing and supporting Internet based distance learning students. Since Internet based courses are available for students 24×7, many students assume that the professor too is available 24×7 via e-mail or other Internet communication means. It is recommended for professors to clarify "online virtual office hours" in the beginning of the course and avoid this problem.

As the pressure on professors to teach over the Internet increases, time devoted for research and publications becomes secondary. Combined with that the fact that some institutions don't consider development of Internet based courses as a valid contribution to tenure review, the enthusiasm among professors to develop one greatly effected (Berg 2000).

There are two common methodologies about the development of Internet based course. The first one, which most educational institutions and administrators elected, is the notion that by providing sufficient incentives professors will develop their own course. This methodology presents many challenges for professors; many try to learn HTML, graphic and image development and other so called "new" technical skills. This unjustified challenge force many professors to learn these skills and eventually produce an online course. Although most professors correctly feel that these new skills are outside their job descriptions, and slowly abandon Internet course development and even teaching over the Internet. Also the lack of a uniform development and technical support produces in many cases amateur presentations and courses are not being consistence in the "look and feel" for students. There are too many educational institutions that try to educate their professors about Internet course development, instead of concentrating on helping professors to develop new ideas and changes needed for course curriculum appropriate for Internet delivery.

The second methodology is based on the notion that the professor has the knowledge and is the content expert and s/he should provide the initial content, ideas, and learning objectives, to a professional development support team who will provide the actual development of the course. Only few leading educational institutions and administrators understand this methodology that is popular in the business world. By doing so, institutions can greatly benefit from economies of scale in the development of Internet based courses and achieve consistent professional interface throughout their Internet based courses or Internet based degree programs.

Course and content copyright is another issue most professors feel very compassionate about. Some educational institutions state that while the course content is copyrighted to the professors, if developed by them, other institutions state that if the course content is converted to digital format and placed on the institution's servers by using funding from that institution, the copyrights ought to belong to them.

A common issue voiced by first generation Internet based distance education professors is the lack of control over the learning pace of students and limited communications with them. It is known that in order to be productive in asynchronous courses, students must posses excellent time management and self control to make sure they are up to date with the learning and assignments requirements. With individuals busy workload and working families it is very difficult for individuals to restrain themselves and devote time to learn and work on assignments after an exhausting work day, the need to pick up the kids from daycare or school and do some other errands. Effective teaching methods of first generation Internet based courses will engage students in stimulating discussions using bulletin board, and send reminders ahead of time via e-mail. While in the second generation systems students are required to attend live sessions forcing them to devote time to learn, and at the same time, the learning pace during lecture is back in the hands of the professor.

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One of the most common questions that alarm professors about teaching over the Internet is related to quizzes and exams online. How do you know who is really taking the exam? Well, the answer is that we don't know. One way to look into this issue is by rethinking the course assessment mechanisms professors use when going online. As we move courses to the Internet, we must think about the new medium, its benefits and limitations. Therefore, it is recommended for professors to change the learning assessment mechanisms they use for conventional courses, and start looking at other and new learning assessment mechanisms that will fit the new course delivery medium. For example, while in many conventional courses, most professors assess the learning by mid-term exam (40% of the grade), final exam (50% of the grade), and class participation (10% of the grade). Over the Internet it will be wiser to consider having small quiz every week with total of 40% of the final grade for all quizzes, have individual or group assignments for another 30% of the grade and make more emphasis on class participation, bulletin board contributions, chat sessions participation, etc. for as high as 30% of the grade. When doing so, students will less likely have someone take the exam for them, as there are too many small assignments and quizzes to do rather than one or two major exams. When using open-ended questions exam, professors can pick the writing style of the bulletin board, e-mail, chat, and other open-ended or essay assignment and compare it to the writing in the exam, although this can be time consuming.

Class or group discussions are much more important when teaching via the Internet. In some cases anonymous student responds can greatly benefit the professor about the pace of the course, and the need for more explanations or discussion issues. Students are more apt to talk freely, particularly when it involves international students or students with English as their second language who feel much more comfortable using asynchronous type of communication tools, such as e-mail or bulletin board, where they can check their spelling and grammar, rather than being shy and not respond at all.

In summary, as today's professors' low compensation, limited support and stressful time constrains, it is crucial for professors to self-advance and get acquainted with new educational delivery and new dissemination technologies. Professors with experience teaching Internet based courses are much more marketable and demanded than professors without any experience in this area. Although face-to-face teaching is not going to fade away, as some think it will, knowledge and experience in this new type of teaching can also affect and improve teaching styles in general.

THE ADMINISTRATOR, IT ADMINISTRATOR:

Higher education administrators are very much interested today, more than ever, in Internet based distance education programs, as they face declining student enrollments, aging student population, and reduced level of federal, state, and local funding. On one hand this resulted in higher competition in the higher education market, that requires educational institutions to become creative and student oriented. On the other hand, this resulted in a rising number of institutions that are looking for new innovative ways, mainly by the use of new technologies, to attract students in remote or distance locations (Barker et al. 1989). Some higher education administrators were under the impression that class size is not limited any more as there are no physical restrictions on the number of students that can be taught via the Internet by an individual professor. This was clearly proven wrong and today most common professor-to-student average ratio is somewhere between one-to-thirty and one-to-forty-five without TAs.

As these new technologies emerge, so does the issue of training professors on using it and the issue of developing in-house experts on course development using the tool and administering it. In particular, when talking about Internet based courses, the issue of professor training is raised in many educational institutions. This comes back to the point I made before about the main difference between the two methodologies of developing Internet based courses. If an institution is training professors to develop their own courses from scratch, it will be very time consuming on the professors' time, make some professors uncomfortable with it, as this is clearly not their area of expertise.

Institutions should not spend the time and money on training professors to develop their own courses, as we don't train vehicle drivers to assemble cars. Rather, they should train professors to use the tools and to deliver their content via the Internet in the same way we train vehicle drivers to drive it and obey road signs. It is much better to have a professional development team coordinating Internet based course development with the professors rather than have the professors develop their own courses.

A professional development and support team can be an outside consulting firm or it can be a team of instructional media developers and programmers inside the institution. In some cases it will be much easier, and definitely much cheaper, to manage a local team within the institution rather than contract an outside vendor. Obviously retaining IT and instructional media developers in educational institutions is a tough issue today. Institutions can provide some "hot" incentives, such as substantial subsidy or even full coverage of tuition or other benefits easily provided by any institution. In some cases using an inside group can provide the institution a great first-mover advantages, as these employees know the environment and settings of the institution. This advantage can provide great benefit in establishing name in the market along with constant improvement (Reichand and Benbasat, 1990). Using outside consulting company or Internet course development company can be quite expensive. Furthermore, most of these companies will not reveal the pitfalls and complications most likely to emerge during the development and implementation of an Internet based distance education program, as these are the holes in their contracts that they can capitalize on when the educational institution becoming dependent on them for the continuation of the development and implementation.

Pertaining the content copyrights, some of these Internet based development companies don't mention it specifically, but they most likely to hidden it in small print within the contract. They will possess the copyrights for the format of the content they developed, making the educational institution dependent on that company for as long as they wish to deliver these courses via the Internet.

In summary, there is a clear rising interest among many administrators regarding Internet based distance education systems. Many feel that these systems could help them attract students in new and remote markets, while also enable their professors to teach more students at the same time. It is true that Internet based courses can help institutions reach new markets, and even provide complete degrees to students who never let foot on-campus, such as the one from University of Arizona, it is not true, however, that these courses will help professor teach more students. As this medium require more attention given to each student and can make faculty overwhelmed with electronic messages which can be time consuming. Nowadays most universities and higher education institutions charge premium for students taking Internet based distance education courses, I predict that in the next decade the coin will flip and students will have to pay premium for a seat in a conventional classroom.

CONCLUTIONS:

In this article I have attempted to stimulate students, professors, and administrators to pay closer look at Internet based distance education systems. As the first generation Internet distance education systems are in place for several years, a new emerging second generation systems are emerging, enabling professors to regain the control over the learning pace and provide lectures over the Internet similar to conventional on-campus courses. As mentioned in this article, an integrated system using both the first and the second-generation Internet based distance education system will provide the most benefit for students and professors. Although it will make the lives of IT administrators much more complicated as supporting both systems in parallel mode is not an easy task, it is likely to be a great value for students.

The tremendous growth of Internet based education or online learning in the business world and corporate universities in the past few years, is making its way to the academic world. As more and more individuals are stressed for time and demand to expand their education and knowledge, a greater pressure is set on higher education institution's and university's administrators to come up with new innovative ideas and new technologies to satisfy these needs. As a result professors will have to spend more time educating themselves on these new tools and ways of teaching in this new medium.

As most new technologies, Internet based distance education systems require training and learning mainly from the professors' end, as they are the ones to use it the most. If administrators will understand that the role of the professors is to provide the content, review the course development, and

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teach the course, rather than develop it themselves, higher quality products, successful Internet based courses, and satisfied students will be the result. If administrators will continue pressuring professors to learn Internet based courses development instead of learning how to use these tools to teach via the Internet, a lower quality Internet based courses and unsatisfied students will be the result.

Further work in this area could include analysis of data collected from students participating in programs utilizing both first and second-generation Internet based distance learning systems compared to students participating in programs utilizing the traditional first generation systems. In addition, more work is needed to fully uncover our understanding of the ultimate Internet based distance learning system that can fulfill both professor's and administrator's needs, while providing a great value to students.

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From the Catalyst Web Site to MyClass: Scalable Approaches to Educational Technology at the University of Washington

Laura Baldwin, Educational Technology Development Group, University of Washington, USA

The Educational Technology Development Group at the University of Washington creates and manages innovative projects that integrate teaching with technology. Through a network of collaborative partnerships with campus teaching practitioners-learning, technology, and teaching research centers, libraries, and departments-the group leverages resources and spreads promising practices throughout the university. From this unique position as the intermediary between educators and technical support staff, the group is able to facilitate diverse projects from the Web-based Catalyst Initiative which supports innovation in teaching through technology for all UW faculty to MyClass, an innovative Web portal that will allow instructors to quickly manage all of the Web-based resources they need in their courses. MyClass, which will be released in September 2001, will serve as a natural evolution in the group's support model-moving towards a more personalized approach that is still scalable and has the ability to reach even the most wary technology adopters.

Socially Responsible Consumer Surveillance: In Search of Privacy-Enhanced Internet Marketing Practices

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Abstract: Along with the rise of a network-based economy, there is a trend from mass production and mass advertising to mass customization. Many industries are undergoing fundamental shifts. Businesses of various industries are creating variety and customization to keep up with increasingly fragmented demands and heterogeneous niches. These economic shifts have qualitatively changed the dynamics between marketers and consumers. In particular they have created incentives for business firms and marketers to surveil consumers' consumption behaviors. Indeed the increasing popularity of the Internet and the WWW is in part a response to the growing demand for consumer surveillance and easy ways of establishing service or commercial relationships with current and potential customers. Yet concerns about and awareness of potential threats to privacy have also increased. The purpose of the proposed paper is to address consumer surveillance and personal privacy implications of Internet marketing. Rather than taking a pessimistic stand that treats all consumer surveillance as malicious coercive attempts from online marketers and all are detrimental to personal privacy, this paper proactively looks for the possibility of consensual online consumer surveillance practices or privacy-enhanced online marketing practices.

The Internet as well as the WWW in recent years has become an integral part of the emerging network service economy. Along with the rise of a network-based economy, there is a trend from mass production and mass advertising to mass customization. Many industries are undergoing fundamental shifts. Businesses of various industries are creating variety and customization to keep up with increasingly fragmented demands and heterogeneous niches. These economic shifts have qualitatively changed the dynamics between marketers and consumers. In particular they have created incentives for business firms and marketers to surveil consumers' consumption behaviors. Indeed the increasing popularity of the Internet and the WWW is in part a response to the growing demand for consumer surveillance and easy ways of establishing service or commercial relationships with current and potential customers. Yet concerns about and awareness of potential threats to privacy have also increased.

The purpose of the proposed paper is to address consumer surveillance and personal privacy implications of Internet marketing. Rather than taking a pessimistic stand that treats all consumer surveillance as malicious coercive attempts from online marketers and all are detrimental to personal privacy, this paper proactively looks for the possibility of consensual online consumer surveillance practices or privacy-enhanced online marketing practices.

Specifically, the paper will first explore the concept of surveillance. Surveillance means systematic observation. Drawing upon Jeremy Bentham's original conception of "panopticon," which describes the architectural design of a prison that would facilitate efficient surveillance of prisoners, Foucault extends the conception from prisons to referring to institutions pertaining to, but not limited to, disciplinary purposes. The essence of Bentham's conception of panopticon is "seeing without being seen," that is, the asymmetry of knowledge of existence between the one who surveills and the one who is surveilled. The one who is surveilled cannot be sure about the co-presence of the one who surveills, so the surveilled has to behave in such ways as if the one who surveills is always present.

Unlike Foucault's conceptualization of surveillance as disciplinary power, Giddens further postulates that surveillance is fundamental to the exercise of administrative power. In essence, For Giddens surveillance is regarded as a means of accumulating authoritative resources and exercising administrative power. Giddens further recognizes the asymmetric resources and capacities between institutions and individuals in exercising administrative power. The ones in higher levels of administrative hierarchy have distinct advantages in conducting administrative surveillance. Advanced interactive network technologies such as the Internet are further strengthened as highly efficient panoptic tools surveilling human activities in the cyberspace. Information about consumers is systematically gathered and exploited by commercial interests.

In this paper consumer surveillance refers to systematic observation of consumers' consumption behaviors and use patterns based on, as well as generated from, information yielded from interactions and transactions. In the case of Internet-based online marketing, consumer surveillance includes the collection and use of consumer information for the purpose of generating consumer profiles for marketing purposes primarily. As mass production is being replaced by customized production, mass marketing is increasingly replaced by customized marketing to target, to locate and to persuade special segments of consumers. Consumer surveillance thus involves massive information collection on consumption behaviors and patterns. Consumer surveillance is regarded as a precondition for the success of customized marketing and this, in turn, requires information as to whom the goods or services should be customized for. Consumer

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surveillance, from the perspective of marketers, serves as an efficient tool to facilitate customized marketing. Yet from the perspective of consumers, often it tends to detract from consumer privacy.

Secondly, the paper then will turn to explicate the concept of privacy. According to Warren and Brandeis, privacy refers to solitude and control over other's access to one's private thoughts. They acknowledge privacy as an individual right to life and relate it to the right to be left alone. Westin (1967) defines privacy as the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others. He further states that "each individual is continually engaged in a personal adjustment process in which he[/she] balances the desire for privacy with the desire for disclosure and communication of himself[/herself] to others in light of the environmental conditions and social norms set by the society in which he[/she] lives". Westin's conception of privacy refers to a claim, and a self-adjustment process in response to the environmental conditions.

Altman maintains that privacy marks the limits and boundaries of the self. He further posits that "privacy is a boundary control process whereby people sometimes make themselves open and accessible to others and sometimes close themselves off from others" (Altman, 1977). In other words, privacy refers to individual's control over the disclosure of his/her personal information in relation to others. It is suggested that the ability to control the boundary process, that is, the flow of personal information, is crucial to the development and maintenance of social relationships and a sense of individuality.

Instead of considering privacy merely as a legal right or a claim, this paper regards it as a social construct. Although it often implies a state of solitude, the concept of privacy does not merely mean a state of solitude. It is more a relational concept; that is, it is meaningful only in relation to others in some sort of social conduct. In an environment where absolute solitude is warranted, the term "privacy" becomes meaningless because it does not signify anything. In this paper privacy refers to the capability of negotiating boundary conditions with others in social relations. The process of negotiating boundary conditions with others in social relations is essentially a communicative one. This conception of privacy includes control of both outflows and inflows of information in different social contexts. In other words, privacy is the ability of a person to decide what and how much personal information is to be disclosed to others in different social encounters, including how others may use the disclosed information, and who may initiate contact with the person, in either proximate or virtual spaces.

In order to effectively participate in the wired society, individuals are compelled to render personal information to electronic systems of not only government agencies but also business firms. As personal information increasingly is collected and stored as a result of firms' interests in surveillance of consumers' consumption behaviors, individuals are losing control over the flow of their personal information. Conducting Internet marketing effectively necessarily involves the collection and use of consumer information. However, collecting consumer information excessively or coercively, and using such information for purposes without consent constitute invasions of consumer privacy. Indeed, in the customized production-marketing economy, firms systematically and massively collect customers' personal information. Various transaction-generated information about consumers even has acquired values in and of itself. It has become commonplace that firms are buying and selling their collections of customer information without customer consent. The generation of consumer information has become a major line of business or even the main business for some firms.

With the basic understanding of the conception of surveillance and privacy, privacy-enhanced online marketing or consensual consumer surveillance thus may no longer be impossible but become negotiable. The paper will further explore essential characteristics constituting consensual surveillance. Finally the paper will focus on identifying common online marketing mechanisms and practices. In conclusion, a set of privacy-enhanced or consensual consumer surveillance practices and policies will be generated.

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The Michigan.gov Story: Reinventing State Government Online

Presentation by Dan Lohrmann, e-Michigan Chief Technology Executive

WebNet 2001 Conference, Orlando, Florida
October 23-27, 2001

Introduction

As the Internet continues to revolutionize the way companies interact with their customers worldwide, most governments are also re-examining the way they provide services in efficient, customer-focused ways. This document demonstrates how Michigan's State government is achieving Governor John Engler's vision for Michigan of becoming a leader in providing online government services.

Many of the challenges and obstacles which governments face are the same as those faced by major corporations in the private sector. Both public sector and private sector organizations strive to improve relationships with customers (citizens, businesses and State employees) and suppliers (contractors and businesses), while at the same time decreasing the cycle time (and cost) of required tasks and processes. Both seek to continuously improve the way "knowledge workers" make decisions by increasing the amount of relevant information available to staff from experts and industry "best practices." Both have the latest technologies as enablers: faster and better computers and networks, web-enabled application software, and even artificial intelligence. Meanwhile, both struggle to keep up with the rapid pace of change.

In addition, governments face a myriad of unique challenges. The Freedom of Information Act (FOIA) provides open government records to everyone. Policies in areas such as privacy, security, accessibility, and even linking become political items open for public debate. Enterprise portal funding models vary widely, with some governments sanctioning the use of advertising and others prohibiting advertisements. Government portals must break down traditional "stove pipes" which exist between agencies, while continuing to support a variety of disparate business functions such as issuing licenses and reserving State park campgrounds. Perhaps most importantly, governments can leave no one behind in providing services and must address the "digital divide."

Michigan's Strategy

Many questions arise in government portal development. What data should we collect from citizens? How much aggregation of information is acceptable? Should we use cookies? Who should be allowed to advertise on State web sites? How do we strike the right balance between building a world-class enterprise portal and limiting expenditure of tax dollars?

To resolve these issues and create a unified State approach to "web-ifying" government services, Michigan's Governor John Engler established the e-Michigan Office in May 2000 via Executive Order 2000-6. This office is charged with leading all of the State's electronic government initiatives. A primary focus of this initiative has been the development of a revolutionary government portal – www.Michigan.gov -, which was launched in July 2001 and is continuously being improved. This portal is revolutionary because it takes into consideration each of the questions asked above and provides citizens with a comprehensive, personalized State government experience that can be accessed 24 hours a day, 7 days a week. The site is organized by customer need so that customers no longer have to know which State government agency provides the service. In additionthe site offers over 70 interactive services.

Driving these initiatives is the Governor's vision that Michigan is to be the leading state in providing trusted electronic government services to all customers. In this regard, he established the specific mission of the e-Michigan Office, as follows:

"e-Michigan will rapidly increase access to the State's services and information for citizens, businesses and State employees through leadership and coordination of relevant and innovative technologies. We will partner

with State agencies to transform and improve government operations in pursuit of an integrated e-government portal, organized according to the interest and needs of its customers."

Building upon the Governor's vision and this mission, the e-Michigan Office's roles and responsibilities were established to ensure a common, yet distinct, understanding of the Michigan strategy for all of the State's electronic government initiatives. These roles and responsibilities are as follows:

Manager of Enterprise Customer Relationships -- e-Michigan assumes responsibility for selecting and managing the processes and the technology associated with each customer's web experience.

Implementer of Enabling Common Processes -- e-Michigan is the driving force behind the initiatives or applications with enterprise-wide implications such as electronic forms and a common payment module.

Establisher of Global Internet Standards -- e-Michigan's role as program manager includes the selection (in conjunction with agencies and the State's CIO Office) of standards directly related to the State's web activities.

Reorganizer of Existing Content and Applications -- e-Michigan will ensure that navigation of the new State of Michigan web portal is driven by the orientation and "life experience" of the customer, not by the agency or department in which the information or application currently resides.

Developer/Incubator of Web-based Applications or Initiatives -- e-Michigan reserves the authority to assume project/initiative management responsibility for transactional applications that either do not exist, have fallen behind schedule, or are deemed otherwise unsatisfactory in their current condition.

Technology Approach

In the autumn of 2000, the State of Michigan decided to aggressively pursue the development of an enterprise-wide portal to:

- Provide a single window to the State's online services and information
- Organize and present content in a logical, easy-to-use format
- Centrally focus e-commerce technology investments and best practices
- Improve the way "knowledge workers" make decisions by providing an increased amount of information in an organized fashion
- Improve cycle times of processes and decisions
- Increase customer satisfaction by adding an easy-to-access, 24x7 channel for delivering services
- Meet the demands and expectations of customers who prefer to do business online
- Save operating costs by streamlining processes

Through a competitive bidding process, the State selected Deloitte Consulting to assist in the development of a statewide e-government strategy and provide advice on current best practices from the private sector in the development of enterprise portals. In addition, the e-Michigan Office brought in several vendors to discuss their recommended approaches to implementing Michigan's e-government vision.

Following State government procurement guidelines, a Request for Proposal (RFP) for portal technologies and services was created and sent out in December 2000. Sixteen responses representing the most commonly used portal technologies in the public and private sectors were received in January 2001. Ultimately, the State decided to award the contract to IBM Global Services. The products proposed by IBM are illustrated in the following chart. This comprehensive approach was validated by reviewing and speaking with numerous positive client references provided in the proposal.

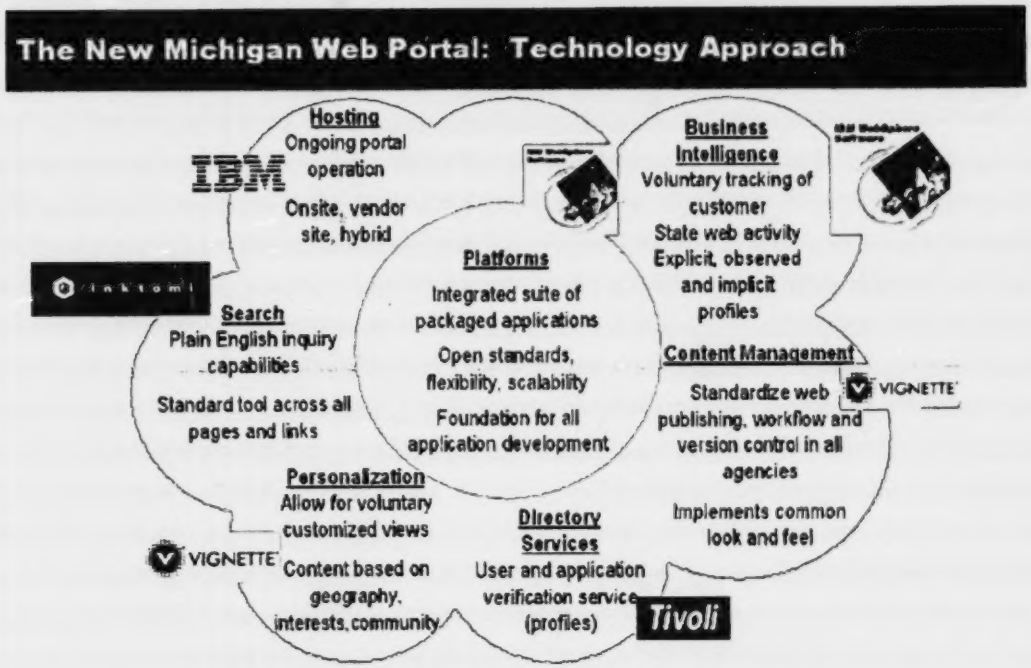

Figure 1

The e-Michigan office followed a very aggressive timetable for implementing the new portal. IBM began work on April 2, 2001. The project manager for IBM informed the State staff that these efforts typically take eight to nine months - yet our first portal launch of Michigan.gov was due in 90 days. A Center of Excellence (COE) was created for Vignette Content Management to centralize the development of templates, which could be used across State government. This "best practice" was validated by many vendors as being the optimum method for gaining efficiencies in content management across State government. (Note: previously, these functions were decentralized in the twenty different agencies.) COE staff were provided detailed training in Vignette development and content management.

The first portal launch in July 2001 included a new customer-designed State front page using Vignette, a revised website for the Governor, theme sub-portal pages which aggregate content by customer need rather than state agency, a natural language search engine, framed agency web sites, and a new domain (Michigan.gov) for Michigan's portal *and* State email system.

The second portal launch in early October 2001 included pilots of single sign-on, a shopping mall approach to purchasing items from the State, and several other functions using IBM Websphere Commerce Suite.

The agencies across State government are now moving their web sites into the Vignette Content Management System by May 2002 with the assistance of the Content Development COE. This migration is well underway.

Organizational Approach

A best practice for the State of Michigan is that e-Michigan has clearly defined executive sponsorship, from inside and outside State government. Foremost is the proactive involvement by the Governor; his entire Cabinet of department directors in the Executive Branch; an Advisory Council consisting of prominent private sector leaders who make best practices recommendations for implementing e-commerce in all areas of Michigan; and the e-Michigan Office, itself, directed by Stephanie Comai, a member of the Engler Administration since 1991.

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Overall, more than 250 State staff are involved in e-Michigan's success. Only 10 to 15 percent of this total is comprised of the full-time e-Michigan Office staff, which includes State and vendor personnel, and the Center of Excellence. The remaining 85 to 90 percent of those involved in the project participate on committees, in groups, and as subject matter levels of varying degree. The e-Michigan organizational structure is illustrated in the following chart. Detailed descriptions of each entity are available at this link: http://www.michigan.gov/eMI/CDA/eMI_CDA_Frame/1,1307,,00.html?frameURL=http://www.state.mi.us/migov/e-michigan/.

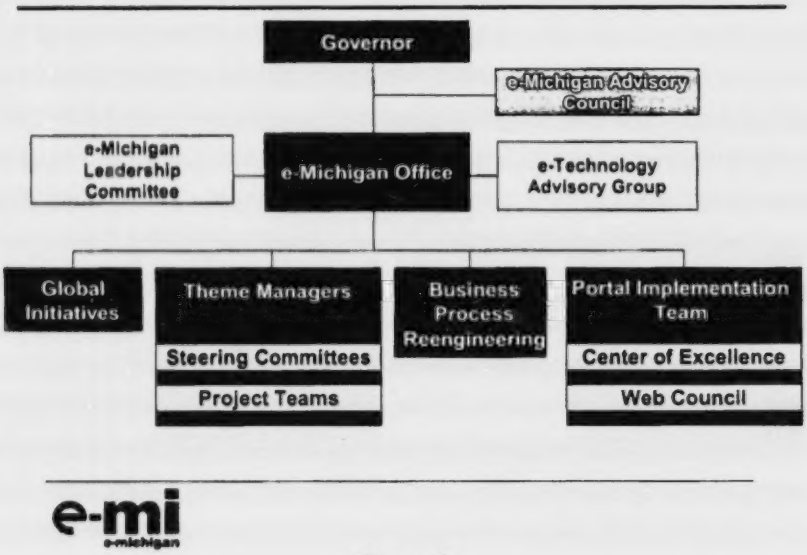

Figure 2

Privacy, Security, Linking and Accessibility Policies

Perhaps the two most publicized issues regarding the Internet are security and privacy. Both public and private organizations spend a considerable percentage of their money and time contemplating, and then implementing and enforcing, these policies. Many organizations have created Chief Privacy Officers, as well as Chief Security Officers. The e-Michigan agency was charged with creating and maintaining the new, up-to-date, policies in these, which are applied to and supported by all government agencies within Michigan State Government. In addition, the Americans with Disabilities Act (ADA) requires federal government web sites to be accessible to those with disabilities. Michigan.gov is compliant with ADA and World Wide Web Consortium Priority Level 1 of the web content accessibility guidelines. Michigan.gov has also issued a linking policy, which describes the conditions upon which the State provides links to other web sites. The full text of each policy is available at www.Michigan.gov.

Business Process Reengineering Approach

Due to the strong emphasis on streamlining business processes in tandem with web innovation, e-Michigan must establish guidelines for process improvement initiatives. In a classic business process reengineering model, process improvement is conducted in anticipation of technological change. However, in an environment where front-end solutions are at a premium, e-Michigan must carefully balance the imperative for "live" applications to be implemented rapidly with the need for back-end improvement. Accordingly, the e-Michigan Office assumes the responsibility of ensuring that the business process impacts of all web development activities are identified

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and a strategy for their resolution is enacted. Additionally, e-Michigan facilitates the development of measurable objectives for all web projects.

Customer-Driven Portal Design

To effectively and efficiently develop the design of the State's new web portal, the e-Michigan Office assessed nearly 100 existing State web sites in 2000 and rated them on information content, ease of use and navigation, layout and design, features and services usage. Additionally, the project used customer focus groups to determine the theme areas and then the design of the look-and-feel for the portal. A total of 15 focus groups and more than 250 customers were used to obtain feedback, and were representative of varying age groups (9-10, 13-18, and 18-75), and diverse geographical regions of the State (Grand Rapids, Detroit Metro, Cadillac, Upper Peninsula). Contacts were made both in person and online.

The focus groups were clear in telling us what they wanted in the portal design. As a result, Michigan.gov employs a common look-and-feel in the form of a banner and ever-present links that appear on all state and agency web sites. This assures customers they are still on a Michigan site. The common links in the banner include Michigan.gov, an agency directory, the search engine, contact information, and privacy and security policies. When you view the graphic below, notice the following characteristics, all of which resulted from focus group feedback:

- Statewide search capability (so visitors can search all State agency web sites at once simply by typing in a natural language question)
- Privacy and security statements
- Ability to go straight to an agency web site, if desired
- Organization of content by the six Service Themes
- Personalized "My Links" (so visitors can voluntarily personalize experiences with Michigan.gov by indicating topics of interest; the system will provide updates with each log-on)

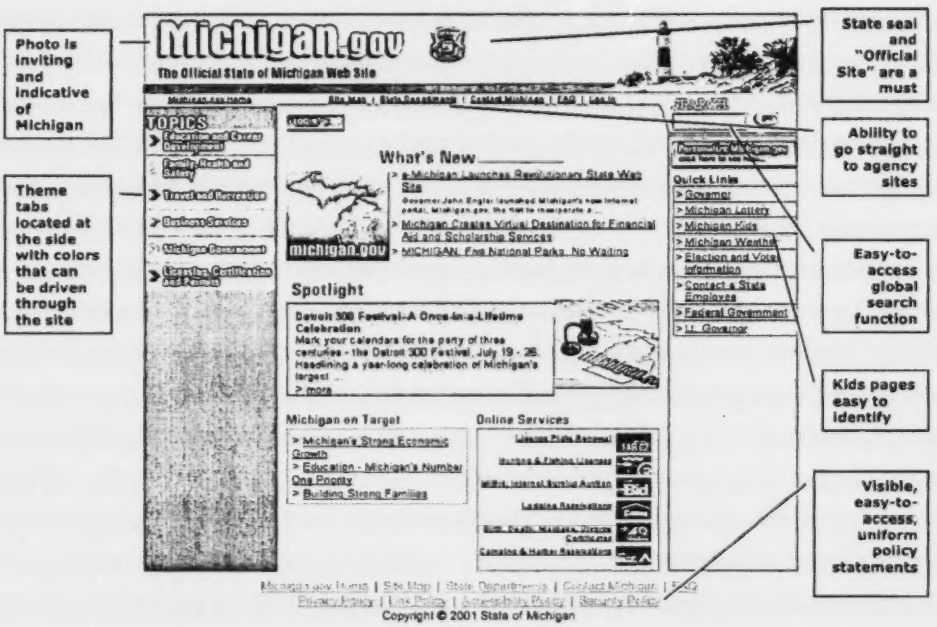
Photo is inviting and indicative of Michigan
Theme tabs located at the side with colors that can be driven through the site
State seal and "Official Site" are a must
Ability to go straight to agency sites
Easy-to-access global search function
Kids pages easy to identify
Visible, easy-to-access, uniform policy statements
Michigan.gov
The Official State of Michigan Web Site
TOPICS
What's New
Spotlight
Quick Links
Michigan on Target
Online Services
Copyright © 2001 State of Michigan

Figure 3

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Portal Content Organization

Due to Michigan's commitment to a web taxonomy based on customer orientation and "life events" instead of agency/departmental silos, the organization of content into "themes" is essential. Service Theme initiatives help ensure that navigation is driven by the orientation and "life experience" needs of the customer, not by the agency or department in which the information or application currently resides. Visitors do not need to know what State agency provides a particular service or type of information. For the first time, customers require three clicks or less from the Michigan.gov home page to obtain the information or services they need.

Service Themes are critical to the success of e-Michigan as they drive a large percentage of the applications and content accessible through the portal. Theme pages not only reorganize all of the online information and services currently provided by the State, they incorporate many new services being launched over the next several months.

Following are brief descriptions of Service Theme areas. For more detail, visit http://www.michigan.gov/eMI/CDA/eMI_CDA_Frame/1,1307,,00.html?frameURL=http://www.state.mi.us/migov/e-michigan/.

Education and Career Development -- This theme area provides information and services for students, parents, teachers, administrators and interested parties. It encompasses programs, services, and statistics that support Michigan's vast network of preschool, K-12, higher education, and vocational training institutions.

Business Services -- This theme area provides a one-stop resource for businesses, workers, and consumers in need of information and assistance from State agencies.

Licensing, Certification and Permits -- This theme area provides State-required professional and occupational license certification and management information for Michigan's citizens and businesses.

Family, Health and Safety -- This theme area provides information and services in support of Michigan's efforts to provide assistance to strengthen the health, safety and quality of life of our families and children.

Travel and Recreation -- This theme area provides information and services to assist customers in their Michigan travel and recreational needs through a comprehensive Internet service encompassing trip planning, State camping and selected harbor reservations, hunting and fishing licenses, special events, seasonal information, and more.

Michigan Government -- The Michigan Government Theme is organized to provide Michigan citizens, businesses and employees information on and access to the organizations and individuals of Michigan government as well as the organizations it sponsors and to provide an access point for all levels of government.

Results

Upon its initial launch on July 10, 2001 the portal provided easier access to more than 70 online interactive services already provided by Michigan. Over the next year, more than 40 new services will be added, including a common payment module, electronic forms and a Michigan government "shopping mall."

These factors establish Michigan.gov as the leader in state government portals in terms of its innovation, efficiency, economy, and functionality:

Innovation

Michigan's portal is revolutionary because it is the first state portal to incorporate the best practices currently in use in the public and private sectors for online services delivery. Other states have attempted to organize agency web sites and some services by themes or categories. However, Michigan is the first state to actually provide

integrated sub-portals for each theme that transcend agency boundaries to provide the customer with the aggregated services and information needed. For example, finding a licensed day care facility in your area and learning how to select the most appropriate service for your needs used to require a visit to both the Family Independence Agency and Department of Consumer and Industry Services. Now, the customer just needs to indicate an interest in day care to be provided with all of the services and information the state has to offer.

An important difference between Michigan's portal and those of other states is that the web technologies put in place to support the portal are being established as standards for all State agencies. Starting in July 2001 and ending by May 2002, all State web sites are being migrated into the Vignette Content Management application. This will facilitate the incorporation of a common look-and-feel throughout all state web sites. It will also facilitate the portal's ability to dynamically aggregate and serve to customers the most updated information on the topics they value most – regardless of the source agency of that information.

Use of a common Vignette content management tool will also place the management of content into the hands of business experts rather than technologists. Currently, each state agency uses extended processes to convert new information from business experts into updated content on a specific web page. This process requires the intervention of web developers, whether the change involves a minor textual issue or the addition of a new file or page. Using the Vignette tool, any authorized publisher can easily add or modify content on web pages without much, if any, intervention with web developers. This will allow web developers and other technologists across the state to focus on more value added activities such as developing new online services and applications. It will also minimize the time between the creation of new content and its publication on a web site.

Michigan has used best practices found in public and private sector industry to establish the look, feel and technologies for the portal. It has implemented a single agency to lead all state e-government initiatives. It has established statewide standards in areas such as content management tools, web platforms, security and privacy policies, and look-and-feel. Finally, it has been launched in an incredibly short time period of 90 days with input from industry experts.

Efficiency

The portal will yield new efficiencies for both customers and state employees. Customers can now quickly find and navigate to desired information and services within just three "clicks" of the mouse. First, the portal groups information and services by customer need rather than state agency so that customers can quickly find and review all possible links and services that apply to their needs. A second alternative for quickly finding information is the personalization of the web site. The portal allows customers to voluntarily personalize their experience so that their favorite links and information are presented immediately upon their entry to the site. Finally, customers can quickly locate information using the statewide search engine.

While the portal simply represents a window to online services provided by the State of Michigan, the true areas of efficiency and cost savings for the State and its customers are being measured at the online application level.

Economy

e-Michigan was funded as a three-year work project by the Michigan Legislature in the 2000 fiscal year. Its initial appropriation was $23,200,000. It has $8 million of unencumbered funds remaining and it intends to spend its full appropriation within the life of the project. Of its initial appropriation, $7,200,000 has been allocated to the portal technologies and hosting services.

e-Michigan's work to increase on-line transactions has the potential to save millions of dollars of taxpayer funds for such things as mailing and printing costs. Examples areas of cost savings anticipated by increasing the online applications provided through the portal include:

- ✓ Mailing Costs: Statewide, over $50 million was spent in FY98 on mailing. Every 10% of mailing costs avoided by using on-line communication results in $5 million in postage savings.

- ✓ e-Forms: Statewide, 30,000 forms are in use, 10,000 of which go out to the public. Research indicates that for every $1 spent on pre-printed forms, $30 to $60 is spent on processing. Cost savings from web-enabled forms will lead to lower forms printing and storage costs as well as reduced staff data entry costs and reduced error tracking and correction.

Functionality

Designed by customers for customers, the Michigan.gov portal is functional in every desirable way. Regardless of the browser or Internet technology used to access the site, customers are able to access and reap the benefits of this new portal. The site is designed to conform to Section 508 of the Americans with Disabilities Act and the World Wide Web Consortium's (W3C) Level One guidelines for accessible web sites. More than 250 customers were consulted in focus groups and feedback sessions as the portal was developed to ensure a clear understanding and fulfillment of desired functionality. Specific features that resulted from these focus groups include a common banner and look-and-feel to all state web sites, an easy-to-locate and –use statewide search function, and use of the State seal within the common banner to enhance confidence that all sites are official State web sites.

In summary, the electronic delivery of State of Michigan services to citizens, state employees, and the business community is being focused through the Michigan.gov portal. This system provides users with an easy-to-understand web portal to government services. State services and access to information are brought into our customers' homes or businesses using a personal computer, and are accessible 24 hours a day, 7 days a week.

Lessons Learned

Since the establishment of the e-Michigan office in May 2000, many lessons have been learned. However, before these lessons are articulated, it is important to note that the lessons learned from the State of Michigan's Y2K project continue to be relevant. An important aspect of any lessons learned document within government is to ensure that previous success factors are integrated into the project from the outset.

Lessons learned through our Y2K initiative that apply to e-Michigan are as follows:

- Executive sponsorship and clear priorities from the highest level of government (in this case, Governor Engler provided this leadership) are critical to success and speed of implementation.
- Effective communication strategies are essential at all levels.
- Good project management (following PMI principles) is a key ingredient to success.
- An excellent, effective, governance structure must be in place.
- Coordination and cooperation between agencies must be regular and consistent, and must provide opportunities for feedback.

All of these factors were certainly in place for the design and implementation of the new State of Michigan portal. In addition, the following lessons were learned through this project:

1) Electronic Government projects can be done quickly (only 91 days from the start of the IBM contract until new portal launch) and on time/budget. To be successful in a condensed timeline, the most skilled and motivated staff and resources must be brought to bear for these projects.

2) Public/private partnerships can work by bringing the best ideas from the Fortune 500 companies and applying them to state initiatives. The need for a world-class content management system was identified early as a best practice in building next generation government portals. Experiences from major auto companies and manufacturing companies assisted Michigan.gov in fine-tuning the best approach.

3) Applying technology is only a part of building a successful new web portal. The required business theme integration, cultural change, BPR, and communications present the biggest challenges to successful enterprise portal development.

4) Test, Test, Test – Even after unit and system tests were completed, many other items were caught in User Acceptance and the stress testing of our new portal. Some new items were even identified at our press conference "walk-through" with the Governor.

5) Keeping the momentum going after major deliverables is difficult, so make sure you celebrate successes and regain your focus on the next set of goals.

Appendix A: Security, Privacy and Other Policies

Michigan has taken great steps to establish privacy, security, linkage and accessibility policies that assure customers of the confidentiality of data and compliance of the site with ADA guidelines. Full text versions of each policy can be found at the bottom of the Official State of Michigan Web Site, http://www.michigan.gov/.

Appendix B: Sample Press Coverage and News Articles

Pre-launch press releases and news articles are listed on the e-Michigan project web site under News & Events: http://www.michigan.gov/eMI/CDA/eMI_CDA_Frame/1,1307,,00.html?frameURL=http://www.state.mi.us/migov/e-michigan/

Following are selected Press Releases listed under the above link:

April 6, 2000 – Governor Signs Executive Order Creating "e-Michigan" Office

August 25, 2000 – Historic Tiger Stadium Road Signs Are First Items on New State Internet Auction Block

March 22, 2001 – MiSeniors.net Launched: Innovative Web Site to Offer Comprehensive Services for Seniors and Caregivers

April 10, 2001 – Michigan Begins Countdown to a Revolutionary Government Web Site

April 12, 2001 – New OFIS Website Focuses on Merged Information & East of Use

April 17, 2001 – Child Day Care Locator Now Available Online

June 7, 2001 –Michigan Rated in the Top 10 for Online Government Services Delivery

June 21, 2001 – Governor Engler Announces New Online Harbor, Lodging and Tee-Time Reservations System

Following is the link to the Michigan.gov portal launch Press Release:

July 10, 2001 - e-Michigan Launches Revolutionary State Web Site
http://www.michigan.gov/emi/1,1303,7-102--2671--,00.html

Following are links to selected post-launch news articles:

July 10, 2001 – Michigan Now More User-Friendly On-Line
http://sns.wxmi.com/news/local/071001-wxmi-net.story?coll=wxmi%2Dnewslocal%2Dheadlines

July 11, 2001 – Engler Introduces New State Web Site
http://www.wzzm13.com/newsdefault.asp?cmd=view&articleid=2059

July 11, 2001 – State Says Web Site Makes Service Easier
http://www.freep.com/news/mich/out11_20010711.htm

July 11, 2001 – New State of Michigan Website
http://www.wlns.com/Global/story.asp?S=398017

July 12, 2001 – Michigan Launches New State Internet Portal
http://fedsources.com/default.asp?mode=sp&path=file_spotlight/s071201-4.asp

July 12, 2001 – Deloitte Consulting and State of Michigan Introduce www.Michigan.gov
http://biz.yahoo.com/bw/010712/2182.html

July 12, 2001 – Michigan.gov: A.I. Goes MI for Launch of New State Portal
http://biz.yahoo.com/prnews/010711/dew037.html

July 12, 2001 – New State Website Easier for Users
http://www.woodtv.com/Global/story.asp?S=396676&nav=0Rce

July 12, 2001 – Michigan Citizens Get 24/7 E-Gov Access
http://www.crmdaily.com/perl/story/11954.html

A Technological Framework for Classroom Assessment and Learning

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Abstract: A framework for classroom assessment and student learning is presented. It focuses on two complementary goals: To provide assessment data for course offerings and curriculum and To augment the classroom experience to promote student learning. The emphasis is on facilitating timely feedback from students and offering alternatives to students with differing learning styles.

Introduction

With recent advances in computer technology to deliver media-rich contents in the classroom, many options are now available for augmenting instruction and learning. This research focuses on getting more out of the classroom experience. Research shows that user-interaction in selecting data keeps the students interested in material (Hannafin & Sullivan 96), thus, students' needs and viewpoints will be considered in this approach. Technology-based solutions will be explored to augment the classroom, including means to assess programs, collect timely student feedback, and provide alternatives to students with differing learning styles.

Much of the current research using technology in the classroom focuses on innovative ways to use finite resources or to overcome other logistical difficulties. Examples include video learning (Anderson 01); on-line classes; and distance learning. Previous related works have contributed significantly to the use of electronic notes with audio and video recording. These include Project Classroom 2000 (Abowd 00) with Zen*; DUMMBO (Dynamic Ubiquitous Mobile Meeting Board) and Stupad; MANIC (Multimedia Asynchronous Networked Individualized Courseware), developed at U. of Mass. (Stern et al. 97); and Project Zeno (Mukhopadhyay & Smith).

Any educational program has measurable goals used by accrediting organizations for assessment. Each program consists of courses that deliver the content, supporting the program goals with learning outcomes. As such, each instructor is responsible to ensure that courses provide the appropriate content for students. A typical classroom experience involves multiple, simultaneous activities or information streams. A system is needed for instructors to demonstrate they have provided the content and a feedback system for students to indicate that they have received it.

Problem Statement

This research will develop a flexible instructional infrastructure to augment the classroom. It will provide a bridge between seat-time and study-time, course objectives and course assessment. It will also provide the connection between classroom instruction and student feedback.

The idea is to electronically record and synchronize multiple instructional stream content in its various forms. The system must be extensible and flexible, working in multiple situations, adding input from different activities at different times. Also, it must be easy to use for the instructor and student, requiring very little additional preparation. It must provide a means to represent the recorded instructional streams in a coordinated manner to instructor, students and course assessment staff. In addition, the instructor must be able to augment recorded material to assist the students. Each student should be able to create links from personal material to course material, facilitating self-directed learning.

CaSA System Design

CaSA (Classroom and Student Achievement assessment) is a flexible framework to augment classroom experience by coordinating and synchronizing instructional streams, matching class plans to student class experience, and presenting instruction in a variety of media forms to promote self-directed learning.

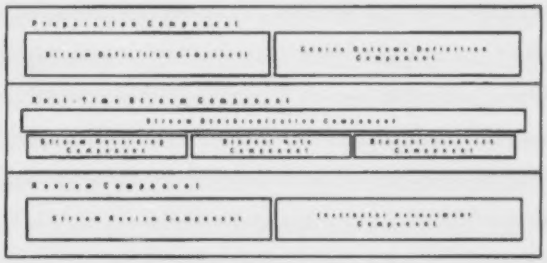

Figure 1: CaSA Component Diagram

The CaSA framework will consist of and coordinate three major components: Preparation, Real-Time Stream and Review components (Fig. 1). They are organized by whether their functionality supports the e-classroom prior to, during or after instruction. The Preparation component allows instructors or course administrators to define the eclassroom experience and Course Objectives. The Real-Time Stream component synchronizes instructional streams with student notes, assessment and feedback. The Review component provides the ability to review and evaluate instructional streams, feedback and assessment data gathered by the Real-Time Stream component.

Expected Benefits

This research provides a basis for an electronic classroom, augmenting the current classroom with information capture and review. By presenting lectures in a variety of media forms, students will be able to choose and access the particular streams that best suit their learning styles and self-direct their learning. Coordinating various instructional streams with student feedback, CaSA will provide the means for instructors to know when and if their intended message was communicated to their students. Also, by reviewing their presentation via the Review component, the instructors will be able to critique and improve their material delivery. CaSA will provide assessment data needed by program and course assessment staff to demonstrate support of program goals. It will provide a flexible instructional infrastructure providing a bridge between seat-time and study-time, course objectives and course assessment, and classroom instruction and student feedback.

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Explor@ Advisory Agent: Tracing the Student's Trail

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Abstract: This paper presents research and development of an adaptive web-based system called Explor@ Advisory Agent capable of tailoring advice to the individual student's needs, actions and reactions towards pedagogical events as well as according to diagnosis of content acquisition. Explor@ Advisory Agent consists of two sub-systems, the Advice Editor and the Student Advisor. The Editor allows course designers to enter the instructional structure as well as the content structure in form of a hierarchical tree, tagging corresponding pages, as well as entering rules (conditions and operations) for how and when advice are to appear. The Student Advisor displays the student's progression through the two structures by indicating what is achieved or completed. The system traces the student's progression according to knowledge acquisition through questions, questionnaires and results on test, and according to how the student navigates through the instructional material. In this manner, the student modeling relies on both the overlay and diagnostic modeling techniques. Future research aims at introducing peer or team collaboration and assistance by allowing the agent to match learners' progress by displaying the progression bars, if the learner chooses to participate.

Keywords: Student Modeling; Adaptive Systems; Interaction and Feedback; Intelligent Assistance

Introduction and background

As the number of online courses and number of student registrations increase exponentially, the need for software tools capable of adapting courses to the individual student's needs becomes crucial. Student or user modeling is the basis for adaptive systems. Student modeling is essentially trying to take into account as many traces (data) as possible about the students behaviour in the system and his hers knowledge status, and then attempt to adapt the tutoring model and/or the learning environment accordingly (Wenger, 1987, Stauffer, 1996, Tsinakos & Mararitis, 2000; Stephanidis et al., 1998;). Obviously, this is not a simple task, especially not in an open learning environment. However, hypermedia and Internet technologies can not only trace the path taken by a learner through a set of hyperlinked pages, but also adapt according to the amount of content learnt by asking questions and then adapt or propose different paths. Most online courses can be seen as a set of hyperlinked documents of differing format (text, image, sound and video), where various types of navigation tools are offered in order to guide the student in his endeavors to acquire knowledge. Brusilovsky (2001) proposes a taxonomy of adaptive hypermedia technologies, which is helpful in contextualzing the type or types of assistance a web-based course should or could include in order to adapt to the learner's need.

One of the classical problems in distance education is the question of providing adequate and individualized feedback to students, either by machine or human assistance. A plethora of communications applications over the Internet (email, forum, videoconference) has to a certain degree solved the problem with human assistance, that is distance education students can now profit from team and group learning, collaborative learning strategies and one-to-one tutoring, both in a synchronous and asynchronous mode (Henri & Lundgren-Cayrol, 2001; Greer et al., 1998). For distance education, the possibility of providing not only interactivity but also tailored advice to individual learners or groups of learners has become a reality.

The main purpose of adaptive systems is to, on one hand, diminish tutors' workload by automating assistance, and on the other hand to provide adapted and immediate feedback or advice according to each learner's behavior and knowledge. To develop adaptive hypermedia systems, it is helpful to differentiate between knowledge acquisition and navigation assistance (Conati et al., 1997; Asnicar, 1997). As for knowledge acquisition, the Intelligent tutoring Systems has served as a model for many learner adaptive systems (Wenger, 1987; Johnson, 2000; Conati & Van Lehn, 2001, Virvou & Moundridou, 2000; Nakabayashi et al., 1997, Weber, 1997), essentially building on the idea that the "tutor" guides the student through some course material by either posing questions, correcting mistakes or giving explanations according to a preconceived scheme attempting to let the student find possible answers or solutions to a problem. The main concern is to keep the student cognitively active. These type of systems can be found in the ITS literature and goes back to the early 70ths (Wenger, 1987; Paquette & Bergeron, 1989; Marcos et al, 1990; Anderson et al, 1995).

The year 1996 is seen as the turning point for adaptive hypermedia systems because of the explosion of WEB applications, number of users, that goes far beyond previous multimedia productions, and also because the number of research projects and theses focused on new technologies providing a whole new area of research (Brusilovski, 2001). Further, he points out that these new research projects were in fact real world systems or "research systems developed for real world settings" (p. 89). Within his classification system the Explor@ Advisory System can be seen as an Adaptive Recommendation System in a closed corpus, where the recommendations or advice adapts to the learner's need by tracing user data (characteristics), usage data (path taken in the system) and environmental data (system data) (Kobsa et al. (1999).

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This paper briefly describes the Explor@ Virtual Campus and the Explor@ Advisory System (Paquette et al, 1996), its architecture and components, followed by some examples of its integration into different types of learning environments.

The Course Environment – The Explor@ Virtual Campus

Since 1992, LICEF research centre has been researching and developing prototypes of the Explor@ Virtual Campus, where many of the features have been transposed to courses at the Télé-université (Paquette, 1995; Paquette et al., 1995; Paquette et al. 1996; Paquette, 1997; Paquette et al, 1997; Lundgren-Cayrol & De la Teja, 1998; Dufresne, A & Paquette, G, 2000). Evolving from an intranet prototype to a server residing system, Explor@ Virtual Campus now counts not only university applications, but also professional training courses.
Most WEB-based courses can be described as a set of hyper linked pages organized according to some principle coupled with some navigational assistance, but usually lacking any kind of individual adaptation capacity. The organizing principle could be the instructional structure, the content structure, a set of competencies or a set of resources needed to carry out some learning task. In the Explor@ Campus courses, via the Explor@ Resource Navigator, a student can access a course from multiple points of view, namely by navigating through the course using the course site, through the tree-structure and by accessing course resources directly from spaces in the Resource Navigator. Figure 1 shows a typical Explor@ learning environment, where the course site can be seen in the background, on the bottom left the Resource Navigator with its five spaces: self-management, information production, collaboration and assistance. The progression bar can be seen in the upper right corner, and below it, the advice window for this particular page.

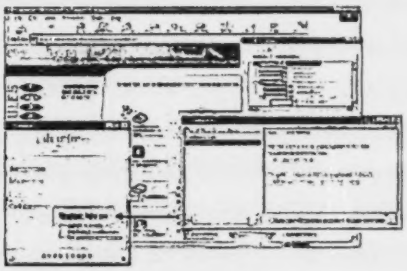

Figure 1 The Explor@ Course Environment with Course site and the Explor@ Resource Navigator.

The Advisory Agent operates in three of the spaces, the self-management space by providing the learner with a progression bar, in the collaborative space by allowing a student to view other students' progression bars and to contact peers, in the assistance space by displaying context-specific advice.

The Advisory Agent
The Architecture
The Explor@ Advisory Agent is one of the agents in the Explor@ Virtual Campus consisting of an Advice Editor and a Student Advisor available through the Internet. The editor allows course designers to insert both content and task specific advice into a web-based course. The underlying student model is based on the learner's progression through a set of instructional events (instructional structure) and the content (cognitive structure). The student model relies on traces captured by the system both according to the overlay and diagnostic modeling techniques.

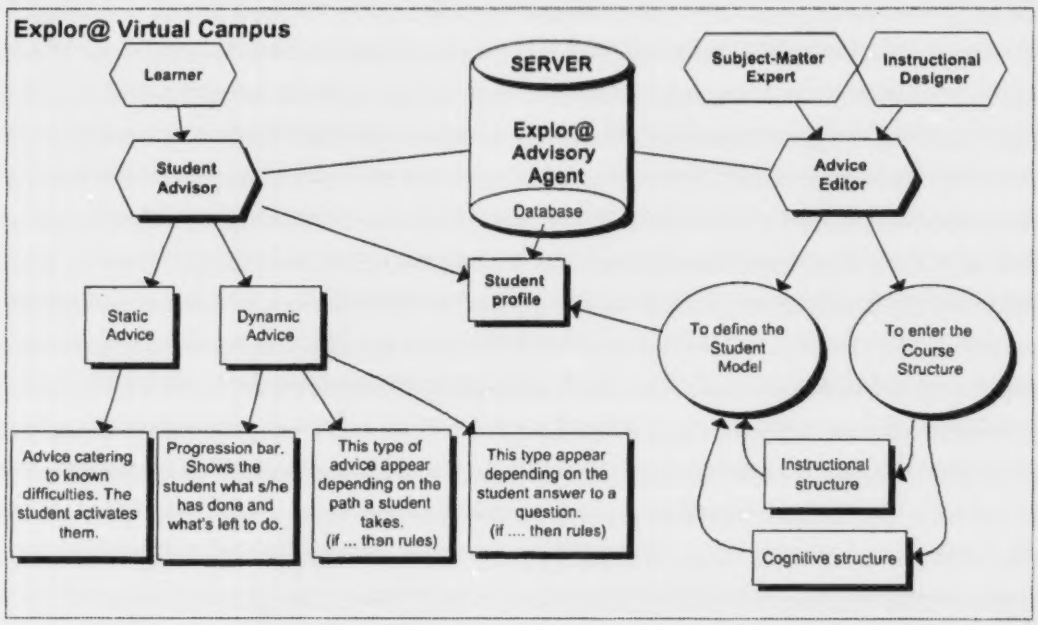
Explor@ Virtual Campus
Learner
SERVER
Explor@ Advisory Agent
Database
Subject-Matter Expert
Instructional Designer
Student Advisor
Advice Editor
Student profile
Static Advice
Dynamic Advice
To define the Student Model
To enter the Course Structure
Advice catering to known difficulties. The student activates them.
Progression bar. Shows the student what s/he has done and what's left to do.
This type of advice appear depending on the path a student takes. (if ... then rules)
This type appear depending on the student answer to a question. (if .... then rules)
Instructional structure
Cognitive structure

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Figure 2. Architecture and components of the Explor@ Advisory Agent

According to the MISA Instructional Design Method (Paquette, 2001) the instructional learning events and the content is modeled via a graphical tool called MOT. These models can be of four kinds: procedural, conceptual, prescriptive or hybrid (processes and methods). The models also include links that determine the relationship between two or more knowledge units or instructional events and its resources. The models are similar to conceptual maps. Using the Advisory Editor, these models can be imported and automatically translated into tree-structures with nodes, sub-nodes and leafs.

The progression bar reflects the learners progression in the two structures according to the weight of importance and the progression mode. The progression can be programmed according to four modes described in Table 1. Each node or sub-node has its corresponding progression bar and weight of importance. The weight of importance reflects the weight (%) that a node has on its main-node, a leaf has on its sub-node. For example, the course X has 4 modules, where modules 1, 3, and 4 is worth 90% of the course, and module 2 is worth 10%. The agent takes into account the weight of importance given to a node, sub-node or leaf when calculating the length of the bar. These two rules determine the progression state in the structures.

Type of progression	Rule	Example
Sequential mode	Sub-nodes or leafs have to be carried out in a sequential manner for the node to be considered completed.	The learner must complete Module 1 before Module 2 or activity 1.1 before activity 1.2.
Modular mode	Sub-nodes or leafs can be carried out in any order, but each must be fully completed before the bar shows the state of the progression according to weight.	Activity 1.1, 1.2 or 1.3 can be completed in any order. Activity 1.2 is worth 40% of Module 1, and Activity 1.3 30%. Activity 1.1 is worth 30%. If activity 1.2 is carried out in full, the bar moves 40%, if activity 1.1. it moves 30%.
Parallel mode	Sub-nodes or leafs can be carried out in any order, the agent calculates the average of completion and weight, and then adjusts the bar accordingly.	Activity 1.1 consists of 3 exercises. All exercises have to be completed. The agent calculates a mean completion rate according to their respective weight.
Optional mode	Only some of the sub-nodes or leafs must be completed for the bar at the node level to insert the completion state.	Activity 1.1 consists of 3 exercises, the learner only have to finish one for the activity to be completed.

Table 1. Type of progression mode and corresponding rule

To adapt the progression bar to an individual's path through the course, the designer can put a time limit on a page. For example, a student browses through the course site, but the progression bar will not change because the designer has placed the condition that for the progression bar to indicate completion, the learner has to stay on the page at least 2 min (see Figure 6 below).

Domain expertise is commonly represented by a conceptual model which is fairly easy to transpose into an hierarchical tree structure, here called the **cognitive structure**. Nodes represent main knowledge units, sub-nodes its sub-concepts and leafs the attributes or facts that define a concept. All domain expertise can not be described by a conceptual model, and it is the designer's task to represent it in a way that it can be transposed into a tree-structure. Each node or leaf can carry a static or dynamic advice. Since a leaf represents the smallest knowledge unit which can quite easily be diagnosed, this is where the diagnostic question feature is made available in the editor.

Pedagogical expertise is represented by a procedural model, called **the instructional structure.** In this model, the nodes represent main events, sub-nodes the activities within a learning event, and the leafs represents the tasks to carry out to complete an activity. It is organized according to what is perceived by the course designer to be the most effective and efficient way of learning some course material.

Another angle of the student modeling technique available in the Explor@ Advisory Agent is the **self-monitoring feature**. The learner manages his own learning progress by deciding whether the agent's diagnosis is accurate by modifying the progression bar to the perceived level of performance in the two structures. The agent takes this information into account and adapts advice accordingly. Advice are appearing according to a rule based "if ... then" system explained in Table 1. In distance education, this feature is essential in order to encourage learners to become self-directed and to take on responsibility for their own learning (Bull, 1997; Ruelland, 2000).

Briefly, the student model takes into account the following traces (data):

- The learner profile (group, email, name, entering and leaving time)
- The learner's navigation path in the structures (instructional and cognitive)
- The resources used (templates, applications and documents of all formats)
- Length of time spent on a page
- Response to questions
- Modification of the progression bar during learning sessions

Table 2 . The type of advice, student modeling method, the designer's task and the learner view.

Type of advice	Method	Designer's task	Learner view
Dynamic • If condition X (action or set of actions) then action Y	**Overlay**	For each sub-node or leaf in the structures: • Identify location (URL) • Identify conditions • Compose advice message	Pop-up advice

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	Diagnostic	For each leaf, where diagnosis is desired: • Identify location (URL) • Compose questions • Compose answer categories • Compose the message of the advice according to each answer For each answer category: • Identify conditions • Compose answer	Questions followed by tailored advice
	Self-monitoring	• Identify type of progression • Identify weight of importance • Define type of manipulation (tutor/learner)	Progression bar
Static • If on page X then set of advice X	**Assistance space in the Resource Navigator**	• Identify which pages (URLs) the advice should appear on • Compose context specific advice.	Advice on demand

The Advice Editor

The Editor has gone from being a rather complicated programming interface to an easy "fill-in form" (see Figure 3 and 4). The course designer is asked to enter the instructional tree structure consisting of nodes (e.g., course modules/principal knowledge unit), sub-nodes (e.g., activity level) and leafs (e.g., task level). Nodes and leafs can be added, deleted or edited at any point.

For each node the course designer enters the title of the node, the abbreviation, the URL, the weight of importance (%) and the type of progression, as explained in Table 1. The designer then decides whether s/he wants to insert a contextual advice, which will appear in the Student Advisor. At the leaf level, the designer enters the above parameters plus decides whether or not to include the self-monitoring feature, that is whether the student will be permitted to manipulate the bar or not, and for how long a student has to stay on the page in order to display pop-up advice or diagnostic questions.

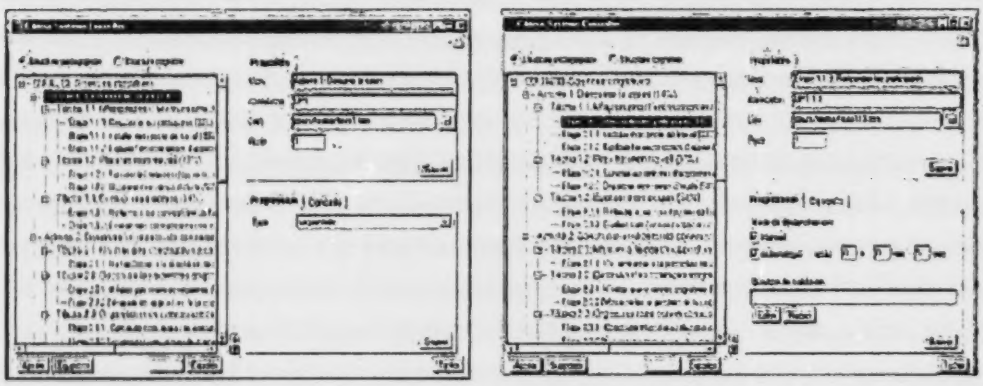

Figure 3 The node editor is shown on the left, and on the right the editor of leaf parameters.

Figure 4 shows the diagnostic question editor, where the designer can enters the questions, answer categories, responses and conditions.

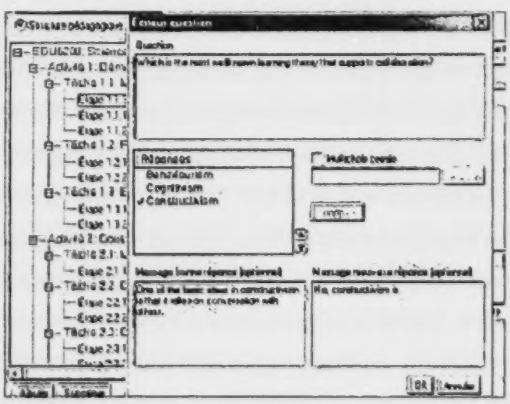

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Figure 4 The Question editor

When the designer has finished entering the static and dynamic advice, the editor can be put in a validation mode, which is the simulation of what the learner will experience once the course is online. The user can switch from validation to editing mode in order to modify and verify the advisory system, until satisfied. This feature has proven very helpful to course designers to determine whether advice really are inserted at the right place and whether there are enough or too many advice, before the course is online.

The Student Advisor

As mentioned beforehand, the student advisor is actually present in three ways :

1. By displaying diagnostic questions and pop-up advice at appropriate while navigating in the course site
2. By making available contextual advice in the Assistance space in the Resource Navigator.
3. By displaying the progress bar for the two structures in the Self-management space

The following pictures illustrate the different types of advice provided by the Student Advisor. They are taken from different learning environments, where the Explor@ Advisory Agent has been implanted. Figure 5 shows how diagnostic questions are displayed.

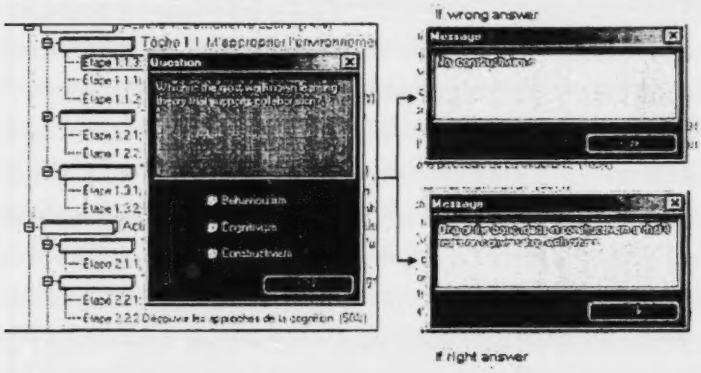


Figure 5 Question with multiple choice with two possible answer categories (right or wrong)

Figure 6 displays the progression bar of the instructional structure in an academic course. The checkmark indicates whether the student agrees with the Advisor's evaluation the progress. By highlighting a node or a leaf and then clicking the right mouse button the student can go directly to the corresponding URL to validate its correctness or ask for corresponding advice.

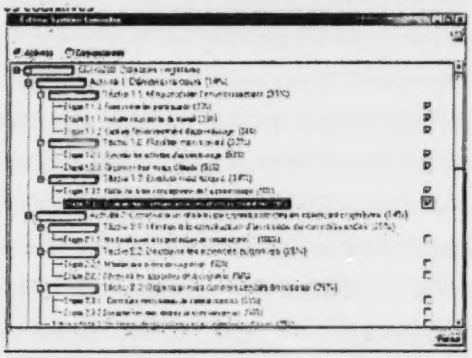
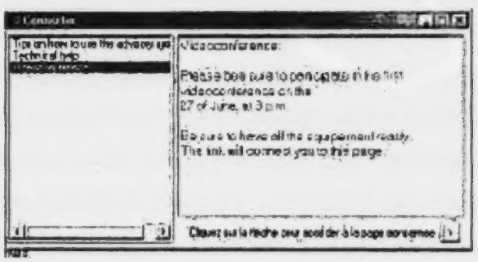


Figure 6 Progression bar in an academic course.

The picture below shows 3 contextual advice for a specific page in a course. Since the third advice is highlighted its message is displayed in the window to the right. On screen, the student can also see the page, but because of lack of space it is not included here.

Figure 7 Contextual advice



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Conclusions

Since 1998, the Advisory Agent has been refined and implemented in several on-line courses and training situations. The first working prototype was the Job Search Advisor (Paquette et al., 1998), which was implanted in several academic courses at the Télé-université. Some of theses implementations have been described elsewhere. You can read about the CVAC (Virtual Center for Continuous Learning), an application that was developed for three professional orders (de la Teja et al, 2000; Damphousse, 2000). Another example is a course on the "Exploitation Code" for linesmen, where the Advisor Agent was implemented in the form of self-diagnostic tests (Damphousse, 2001).

The next step in the endeavours to refine the Explor@ Advisory Agent is to expand its collaborative capacities and to adapt it to all the actors (tutors, designers and managers) in the Explor@ Virtual Campus. The collaborative features aim matching students by tracing the structures and then to program the agent so that it can communicate whether and when help is needed.

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INCORPORATING VIRTUAL REALITY ELEMENTS IN COURSEWARE DEVELOPMENT

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Abstract: This paper deals with incorporating virtual reality elements in courseware development as an effort to enhance the courseware content in a web-based learning environment. The study on the choice of virtual reality development tools is discussed and some advantages and disadvantages of the chosen tools are highlighted. The perception of the content developers and the leamers are also discussed with respect to its features and virtual experience offered based on a survey conducted at Universiti Teknologi PETRONAS (UTP). Overall, the results suggest that the tools worth to be exploited since it meets users requirement in terms of development and respond time on the web. With the tool, more courseware content will be able to have an interactive and immersive element to be experienced by the learner.

Key words: VR *tools, immersive. courseware content*

1. INTRODUCTION

Internet has become one of the important enablers in the e-learning environment due to its capability to inform and interact between a learner and a lecturer electronically. The existing trend shows that universities, academic and corporate institutions are gearing up to provide e-learning to their academic staff, students and personnel via the Internet with considerable amount of budget allocated every year. Huge amount of effort and various authoring tools have been used to develop content-rich courseware, web tutorials, assessments and the like, to make e-learning becomes interactive and fun. While Internet offers the flexibility of learning to the learner, web-based courseware materials continue to be dominance with text-based and still graphics. Very limited sites offer courseware with content rich materials such as incorporating virtual reality (VR) elements. Virtual reality is important to help the learner experience the immersive environment and to help learners have a common visualization of an object in 3D. Cost, long laborious amount of time to develop and bandwidth has been identified among the factors why content developer refused to incorporate VR element in their courseware. This paper will suggest on the possibilities of using one of the many VR authoring tools, which is fast, and easy way to develop inexpensive VR elements in a courseware development. The tool has been used by the e-learning Team at the Universiti Teknologi PETRONAS (UTP) .

2. BACKGROUND OF e-LEARNING AT UTP

Universiti Teknologi PETRONAS (UTP) was formed in 1995 with an objective to produce well-rounded graduates who are creative and innovative with the potential to become leaders of industry and the nation.
To realize these objectives various initiatives have been made incorporating communication and information technologies (CIT) into its multimode of educational delivery. C-learning (classroom learning) will continue to exist at UTP with e-learning as a complementing role. E-learning project is designed to add value to the learning process by enhancing the quality of the teaching and learning. It provides a conducive learning environment by offering customized delivery options, which provide students to knowledge and learning in a wide variety of ways. The objectives of the e-learning project are among others:

- Develop framework for the development of online teaching and learning
- Provide facilitators (lecturers) and students with online facilities to aid teaching and to support learning
- Identify challenges that exist with the current infrastructure i.e. network, technical and staff
- Support research and innovation in teaching and learning
- Support UTP in building the capacity to enhance teaching and collaborative learning

Incorporating VR elements in the courseware development is one of the vital efforts to help realizing the e-learning objectives.

3. VR DEVELOPMENT TOOLS

Among activities that have been engaged by the e-learning team is looking at a number of VR tools that are low-cost, fast and easy for the user name ly subject matter expert (lecturers) and graphic designer to develop. In addition to this, it must be web enable, photo realistic and cross-platform allowing the learner to explore and examine detailed virtual worlds using a computer and mouse. As an initial effort, goggles, headsets or gloves are not intended to be included in view of the high price and the user environment

To qualify for the above, extensive literature review has been performed. Two major categories of VR system were classified namely complete VR systems and software-only solutions. Complete systems usually include closed environments with multiple dedicated workstations. This category also includes an entire range of augmented VR systems that combine certain specialized physical devices combined with digital technologies. Expensive input and output devices such as data gloves, headsets, and body suits, high-powered workstations make complete VR systems neither affordable nor feasible for courseware development. The second category, software-only VR solutions offer a much lower in cost and able to meet most of our criteria set.

3.1 Software-based VR development tools

Software-only solutions can be further divided into two major subcategories: 3D and 2D solutions(1). The 3D solutions integrate true 3D objects and environments, while 2D solutions utilize static images that simulate a 3D environment. In each of these categories, proprietary and non-proprietary technologies exist. Choosing a proprietary technology limits development to those features and functionalities supported, but it was found that the learning curve was less steep compared to the non-proprietary technologies. Since majority of our team had a limited programming skill and prefer a quick result without compromising the criteria set, we short-listed for 2D propriety technology. Our choice leads us to not much of an option since we discovered that QuickTime VR Authoring Studio TM dominated the market. It allows the developer to create object movies, where the user can manipulate an object, or panoramas and the user can view a scene on a computer display. Developers have complete control over the pedagogical degrees of freedom within the illusionary three-dimensional environment and learners can readily interact and understand the environment. We found those features are fantastic and we finally settled on it.

4 Advantages and Disadvantages of the 2D VR Technologies

Based on the hands-on experience with the chosen VR development tool, some of the advantages and disadvantages gathered are highlighted as follows:

4.1 Advantages

The obvious advantage is the development time to develop a panorama or an object is relatively fast for even a new user. Listed below are some of the other advantages namely:

- **Functionality/Features**

Interesting features like object maker and panorama stitcher allow images shot in digital format to be stitched together to create a panorama scene and can be viewed on computers running on Mac OS as well as Windows software through either the QuickTime Plug-in for web browsers available for free or any application that can play Quick Time movies (2). The content developers do not need to have a sound programming skill like Java Applets or VRML to produce such content and can be completed in minutes after some touch-up on the image produced. The plug-in allow learner to experience a more immersive 2D world with 3D imagery and interactive components. Learner are able to view and examine detailed virtual worlds by using a computer and mouse only without head mounted display or gloves.

- **Small file size**

On the average, the file size for 300 by 200 pixels image is below 200 K, which allow it to be used on the web environment. Learners impressed with its photo realistic images and yet they don't require a high bandwidth or expensive high-end graphic card and processor to experience a 360-degree panoramic view or an object.

- **User friendliness**

Generally the tools are user-friendly. Anyone that is familiar with authoring tools or software packages should be comfortable enough to use the tool. The content developer will just need

to follow step-by-step instructions available in the manual to perform the desired tasks. Minimal HTML scripting skills are however required to make it web enable and to link with other pages or images. There are rich resources available over the web should the developer want to enhance the content by incorporating more interactive features through the developer community newsgroup. So far, neither the learners nor the lecturers using the tools give a negative feedback with regard to user friendliness.

4.2 Disadvantages

- **Additional Hardware and Software**

The developers need to have additional hardware and software to develop the VR content, as the tools alone can't perform photo retouching and painting tasks, capturing images and adding sounds. All these have to be included to enhance further the quality of the content at extra cost.

- **Require Browser Component**

To view the learner or end user need to download the plug-in player first though it is available for free. Depending on your bandwidth, this may take quite a while to download, as the file size is quite big (9.3 Mb zip file).

5. LEARNER PERCEPTION SURVEY RESULT

A survey utilizing a Likert-type scale to assess the perception of the learner was conducted using self-administer questionnaire method. The findings are analyzed statistically to test a number of hypotheses generated prior to the survey namely the acceptance of the students to the contents. A one-sided t-test was applied to the hypotheses where the mean score for each tool is more than to 4 for a Likert scale of 1 to 5 (5=Strongly Agree, 4= Agree, 3=Neutral, 2 = Disagree, 1=Strongly Disagree). This show that the majority of the respondents are favoring the VR element to be incorporated in courseware content. In addition a qualitative observation is also deployed to gather information on the responses of the learner who have experienced the VR content as compiled via e-mail and online polling. Beside the above statistics, qualitative information gathered from the lecturers cum developers was also positive. Majority of the lecturers claimed that the quality of interaction continues to improve. Learners ask quality questions as oppose to common ones.

6. CONCLUSION

The availability of the VR development tools should be exploited to the fullest potential, as they are able to deliver an enhanced courseware content. The finding done at UTP has shown that incorporating VR element does give a positive result to learner without really a huge investment in terms of money and time to develop VR element in a courseware. A secondary, tertiary academic institutions and perhaps kindergarten should explore these opportunities, as technical and financial constraint are always a limiting factor in incorporating VR elements in their courseware development. It is envisaged that with a well-coordinated effort in integrating these tools a good and rich courseware content beyond text and still graphic is attainable at low cost and fast development time.

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Telematics Applications - New Perspectives in Healthcare, Education and Working

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OTE S.A. with a group of companies, the Hellenic Telecommunications Organization is at present the leading telecommunications company in Greece and the South-Eastern Europe in many aspects. OTE has played a significant role in the development and promotion of telemedicine, distance learning and teleworking. Efficient use of modern telecommunications technology may contribute to a more effective utilization of resources, tying together those that could be in benefit of the health sectors in the process of implementing a large number of telemedicine services. TELEREMEDY, a Cost Effective Telemedicine Solution Based on Euro-ISDN Technology, is one case of telematics healthcare services based on real time, interactive Euro-ISDN technology for remote diagnosis, management, and education concerning Congenital Heart Disease (CHD). The Boat of Life and Hope is a doctor-boat that gives medical and healthcare support for the most remote isolated and scarcely populated islands in the Aegean Archipelago. In this way all the inhabitants are connected to central hospitals. The telemedicine services and applications networks implemented in Hepirus and land locked areas in Greece can serve as another case to be demonstrated with an evaluation on the perspectives and challenging capabilities that the new technology applications can provide.

Model of the Chydenial Network University

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The Chydenius Institute is an education and research unit of the University of Jyväskylä. As a Network University it gives numerous possibilities for Central Ostrobothnia region by offering modern education and research services based on information and communication technologies. The Chydenius Institute has a regional label. It constitutes the meeting point for local companies, educational institutions and municipalities. It brings equal possibilities for every citizen by marking out routes to the sources for information. The Chydenius Institute is networking with other national and foreign universities. The promoting of the local history and cultural activities by using networks is getting more and more important. Local becomes global — and the opposite. Shortly, philosophy of the Chydenial Network University is to encourage the use of modern communication skills from the point of view of the local needs. Web-technologies, IP/ISDN-videoconferences and ATM/ADSL/WLAN networks are the most common environments when creating services. This development has been natural in hi-tech Finland because of educational and technological investments made in the changing information society.

The Assesment in "an on line Learning Model of Marketing".

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Abstract: At ITESM we are using the concept of "redesign", and this implies the use of a technological support called Lotus Notes-Learning Space. This concept implies a new role for students, the must have a more active role in learning. One of the advantages of Lotus Notes-Learning space is the "Assessment Center", it help the teacher for different activities: a) designing. applying and grading exams; b) To grade and return grades to the students in different activities like reports, task, etc.. and c) To audit the implementation of the course for different teachers in the same period.

The Assesment in "an on line Learning Model of Marketing".

At Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), we are working in a new model called "Rediseño" (redesign). This means that we are working not only in the academic topics, we are considering also abilities, attitudes and worths. This model implies the use of a technological support called Lotus Notes - Learning Space. (LN-LS). One big change is the new role that a student has, he or she need to learn to learn, their role in more active than in the traditional educational models in the past.

In order to teach a class in this model required that all the design and the material that will be used during the period of classes be in the (LN-LS). Before to teach a class in this model a teacher must work in the design of the class. The LN-LS works using the following 5 database: 1) Schedule: Here we can find the programming of all kind of activities divided per week. (Our courses have 16 weeks); 2) MediaCenter: here we can find all the material that supports the course: Videos, abstracts, presentations, printed advertising, etc.; 3) CourseRoom: this is the space designed for make and send the homework (assignments) and the discussions, and also through this database the teacher can graded the tasks; 4) Profile: here we have all the information about the participants of a course (instructors and students). And also here the students can know their grades and the annotations that the teacher made related to their work.; 5) Assessment: This space permits to create different types of evaluation like : quiz, exams, survey, self-Asses. I will explain later about how we use the Assessment Center.

Each course is created in a server at each campus. Then each student needs to replicate the course in his or her Laptop through the use of the WEB or the Intranet. So all the activities that a course implies are in the (LN-LS). Actually I teach Basic marketing, and I designed the course in (LN-LS). In this model I scheduled all the activities, so the student can know in the beginning what he or she has to do during all the semester. The student can know what are the objective of the class, what the teacher expects the student has to do. Also he or she can know what is the homework (assignment), when is the deadline. Also the student can find examples of diverse products that are sell in Mexico. In each theme the student can find an Internet address of Mexican products, so he or she can visit it and he can learn a little bit more about how this companies use the Internet as a part of their marketing effort. This is a particular aspect of how Internet can improve the way of teaching Marketing. The students can see in a dynamic and actual way what is happening in the world. In the past, before the Internet and (LN-LS) we depend on what the companies want to publish in books, articles, magazines or journal.. Here are some examples:
http://www.profeco.gob.mx, http://www.ticketmaster.com.mx, http://www.jumex.com.mx

Another activity that is in the Marketing course is the use of the "Digital Library". Through the server the students at ITESM can access a lot of publications for example: Journal of Marketing, Journal of Marketing Research, Journal of European Marketing, etc. During the semester each student must read al least 3 articles of Marketing. The student makes an abstract and comments about what he or she read. Instead of going to a library they have access form any part. They only need a computer and connect to the ITESM through Intratec, and they can enter to the Digital Library. This is another benefit of the technology. Another important use of Internet and Intratec, is the possibility of put relevant information in the MediaCenter. We use a printed advertising of Mexican products or products that come form other countries but they need to be "tropicalized". The student can see the advertising and answer the different questions related to the topic of the week. They send the assignment through the CourseRoom.

THE ASSESMENT CENTER.

We use the Assessment Center for the following activities: First, a teacher can grade the activities that the student do in the CourseRoom, and we have the possibility to return the grade to the student by (LN-LS) with the comments related to how the student did the task, or to suggest what the student need to study. Second, here it is possible to create a bank of questions, in order to create exams. The program has the option to randomize the questions, so the exams are different for the students. There is four type of questions: true-false questions, multiple choice questions with a single answer, multiple choice questions with multiple choice, and the open questions. In the first 3 options it is possible that the program graded the questions. One of the objectives that we are working on is to increase the bank of questions with the participation of different teachers. We increase questions each semester. One advantage of using the exams in the Assessment Center is that it doesn't matter who is the teacher, the students have the same kind of exams, so there is a big possibility that the students learn the topics that were designed. Third, through the Assessment Center we have the option of Audit how the different courses are been given for different teachers. We have 12 groups of the same subject (marketing) in each semester so we have 5 or 6 teachers, with different styles. So I work in the project of following the implementation and an evaluation of the course of Marketing in Lotus Notes –Learning Space (LN-LS). This project began in the semester August-December 2000, and in the semester January-May 2001. As I am the designer (author) of the course of Marketing, I have access to all the database generated in our server for the different groups. First I built a matrix like the following:

TEACHER	Status	Groups	Students number	Time using the course

The expectations was that an experienced teacher has less problems in the use of the course in learning space. Second I built another Matrix with the following elements:

Activity	Group 01	Group 02	Group 03	Group 04	Etc.	Etc,.
AdvertisingTopic 1						
Ethical dilemma Topic 1						
EXAM Topic 1						
Advertising Topic 2						
Ethical DilemmaTopic 2						
etcetera						

Third, so in the Assessment Center I found the report of how many of the different activities were graded, and I filled the matrix with the number. After that I compared the number of students with the number of activities grades, and I found the deviation. If the difference is low, it is possible that some students didn't do the activities, this is acceptable. But if we found that the difference is big, so we have a problem. And we suggest actions to do with the teacher that have problems. If the problem is lack of abilities to work with learning space we suggest taking a course in the use of learning space. We make a following for the next semester, so we expect that the differences will be lower each time the teacher use the LN-LS course. Of course we understand that learning is difficult to standardize, but we also think we can offer a better service (education) using the advantages of on-line courses.

Conclusions

The use of the Assessment Center is very useful as an active and quickest way of receive and grade the activities the student make. And also we can control the performance from different teachers in our model called "redesign".

A Web Laboratory for a Basic Electronics Course

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Abstract: In this paper we present a Web based laboratory as a complement to a conventional electronics course. Real measures are performed. A web application allows the remote control of the measurement equipment. The Web site contains a basic collection of experimental exercises in circuit analysis. The students are introduced in the electronics circuit by using a java program with a friendly interface. New circuits are easy to add to the Web because the description of the circuit components is supplied to the application from an HTML file.

Introduction

A new paradigm of educational laboratory is emerging in colleges and universities. The Internet technology (Poindexter et al. 1999) allows remote access to laboratory instruments and makes it possible to experiment at any time and from any location. The concept of Virtual Laboratory (Cramer et al. 1997), based on computer simulation enabling the functionality of laboratory experiments, should be distinguished from the concept of Remote Laboratory (Chen et al. 1999). The latter involves experiments controlled by means of a computer networked to the laboratory equipment. Most times, both are described as virtual in literature (Harms 1998, Short et al. 1998). In a Web based Laboratory both approaches coexist, broadening their educational impact. A Web Laboratory offers new educational opportunities and allows a complete "Internet Experiment", where real measurements are performed over the components under test and the data are compared with the simulation results.

Additionally it is possible to hide the inherent complexity of controlling sophisticated equipment. A friendly interface permits students to focus on the experimental aspects. Using a Web browser as an application interface to the laboratory equipment gives a great number of advantages. The students are already familiar with the navigation tool. It is platform independent and the additional software required is minimal. The web tools are easy to use and decrease the psychological barrier involved in facing up a new technological problem.

This paper presents a web based electronics laboratory. The most remarkable features are the remote access and a friendly interface to the student. The developed application includes a series of Java applets integrated on a web site. The experiments presented here, have become a fully acknowledged and integrated part of an electronics course imparted at the University Autonoma of Madrid - Spain.

The rest of this paper is organized as follows: Next section is a description of the system communications architecture in order to provide the remote access. Another section introduces the user

application with a description of features and facilities developed. After a description of the circuit using an HTML file is explained. The organization of the Web Laboratory including feedback information from our students, is presented on next sections. The last one contains concluding remarks and future work

The System Architecture

The remote measurement system has been explained previously in detail (Kadionik et al 1997, Cervera et al. 1999, Gomez et al 2000). Now, we only remark the most important aspect of the system. As schematized in (Fig. 1), the different parts integrating the whole remote measurement are:

1. The measurement instrument is a semiconductor parameter analyzer HP4145B with a GPIB (General-Purpose Interface Bus) interface (IEEE-4888,1999). The real components of the circuit under test are located on a circuit board. The connection of the board and the measurement equipment is shown on part b of (Fig. 1)
2. A personal Computer (PC) or Workstation (WS) running a Web Server.
3. A PC or a embedded controller named "GPIB-LAN adapter" (Gomez et al. 2000), acting as the Instrumentation Server. Both cases equipped with a GPIB and Ethernet interface.
4. The client computer, PC or WS, with Internet access.

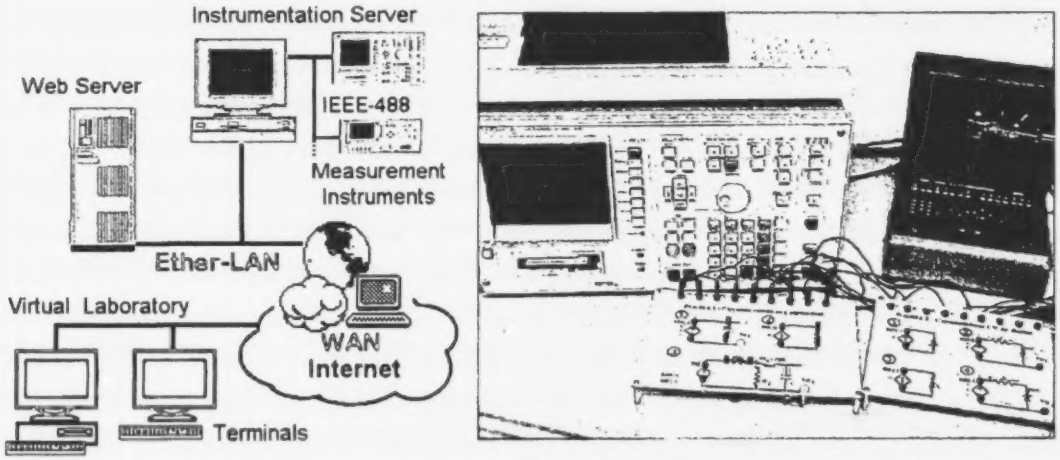

Figure 1 : a) Communication scheme b) Circuit under test and measurement instrument

In this configuration, the remote measurement process can be split in three steps. On the first one, the set up measuring conditions are programmed in the equipment, i.e. value of the voltage source, integration time period, number of measurements, etc. On the second step the instrument receives a trigger command to start the measure, and the values are stored on the equipment. When all measurements have been performed, the instrument sends a service request to the instrumentation controller indicating that the measurement process has finished. On the third step the measure data are transferred from the equipment to the instrumentation server. The equipment programming is accomplished by means of commands sent through the GPIB interfaces.

In addition to control the instrumentation connected to the GPIB interface, the instrumentation server is equipped with an Ethernet card connected to the local area network (LAN). The application running on it, has a server structure with a TCP special port dedicated to this service and has been developed such a way that it is independent from both the measurement instrument and the analysis or test nature to be performed. Its task is to keep on data exchanging between LAN and GPIB interfaces.

The Web Server is implemented by using a Sun UltraSparc workstation running SunOS (Solaris 1998) with an Apache Web Server (Apache 2000). The computer acting as Web server covers various objectives. First of all, it provides web pages with the circuit schematic representation and information about how the measurements have to be performed. As a second task, due to the Java security constraints we also implement a TCP sever on the web station. It works as a communication bridge for the information flow

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between the user and the measurement system, because direct communications between the client and instrumentation server are forbidden. Similarly to the case of the instrumentation server, the information flow is independent from instrument, this means, generic for any kind of characterization or test to be performed.

Finally, on the user computer, an application supplied by the Web server, is executed on a suitable client for the WWW like a browser. This application has been developed in Java (Java 2000), in order to provide multiplatform capabilities. The organization of this application is explained in the next section.

The User Application

The application implements the following tasks:

- Display the circuit schematic design to the user. Three operations are implemented for each circuit: starting the measurement process, obtaining the measure data list or plotting the measured data.
- Show the dialog boxes where the user must introduce the values of current or voltage. These will constitute the set up measure conditions
- Send the adequate commands to be programmed in the equipment with the measurement conditions.
- Send the trigger command to start the measurement process and receive the measurement data
- Show in the dialog boxes each measurement in a sequential process. Each value will be held for a second period
- Display a list with the measurement
- Show a graph with the measurement data

In order to create a virtual circuit we have used an object approach. On top level we have a *circuit* object which represents the real circuit and contains the virtual components of the circuit. The main window contains a circuit schematic representation and three buttons as shown in part a of (Fig. 2). The object used to represent circuit components is called *entity*. Each entity defines the virtual equivalent of a single circuit component, such as a voltage source, current source, etc... In current implementation only four types of entities are available when defining a circuit. It is useful to distinguish between input entity like voltage and current sources and output entity like amperimeter and voltimeter. The main difference is that the first ones need to be configured by the user before the measurement process starts. We have defined these four components because they are available in real instrument, with a maximum number of 4 sources and 4 meters. The system was designed with reusability and scalability in mind, so it can be easily extended to implement new types of components.

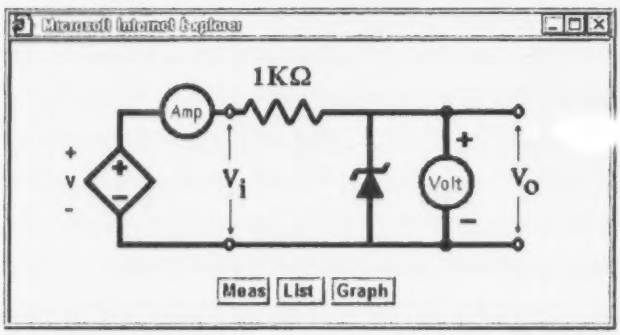

Figure 2 : a) Circuit schematic representation b) Control panel of a voltage source

Every entity object is built on different parameters, specified when it is created through an *entity_definition* object. These parameters are the entity type, the associated entity location in the circuit schematic representation, entity name and source function supported by the entity (linear, logarithmic and

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single). This last parameter has only meaning with an input entity. The single function is defined if only a constant value for the source is desired. The sweep function is defined when the value of the source change from a set of values in a step by step process . Linear o logarithmic sweep is selectable.

Each entity also contains an *entity_control_panel* object. This object manages entity-related Graphical User Interface (GUI) design. The graphical window of the entity control panel is displayed by clicking the entity symbol on the schematic representation (Fig. 2). Typical components of an entity control panel include power-on lights, LCD displays and text entries for component configuration where the user specify measurement parameters, like the start and end value of the source in the sweep measurements. An example entity control panel is shown on figure 2b. Also, a check of the correctness of these parameters is performed according with the compliance values used in the real instrument. Once the component is configured, the entity control panel builds a string with the command to program the instrument in the conditions established by the user. In the case of output entity, the command specifies the name of the component whose values should be measured

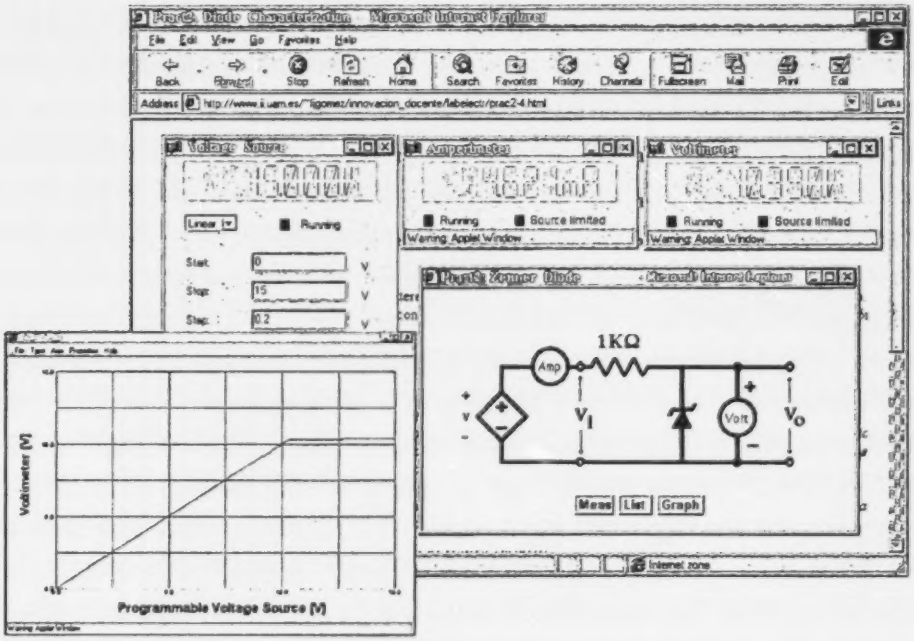

Figure 3 : Application Workspace

After all the input entity present in the circuit are configured by the user, pushing the measure button in the main window starts the measurement process sending the global command obtained by the concatenation of the string generated by every entity. Once the measurement process concludes, the result data are delivered to each entity control panel that displays it on the virtual LCD during a second time period, as shown in (Fig. 3).

By pressing the List button in the circuit schematic representation shown in the schematic of (Fig. 2), a window containing all the measurement results is opened. Due to java security limitations, these data can not be manipulated at the user computer, so a client-server subsystem was developed. It consists in a web gateway developed with PHP (PHP 2000), and a SQL database to store measurement result data. By pressing the Export button, the user application exports measurement result data to standard HTML pages stored on the server. The client can retrieve these results for further analysis with more specific tools.

For standard graphic representation, SmartPlot2D java classes (SmartPlot2Dlibrary 1998) were included in the system. Several representation formats can be achieved by using the different application menus. An example is shown in the window displayed on the left lower corner of (Fig. 3).

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HTML Circuit Description

All the information about the circuit that the application needs to know is stored in a circuit description file written in HTML language. This file contains the main Java applet and specific information about the circuit defined. This information includes circuit image file name , number of components and parameters for each component, such as entity name, type, source function and coordinates of the component in the graphical representation of the circuit. When the user requests the HTML page through the browser, the applet containing the virtual circuit is loaded. Next, the system parses the HTML file to obtain the circuit definition. It also displays the circuit image and creates the panels and elements needed to configure the circuit, performs the measures and shows the results. An example circuit definition file is shown in (Fig. 4).

```
<?php require "auth_engine.php3"; ?>
<HTML>
<HEAD><TITLE>Diode Characterization</TITLE></HEAD>

<BODY>
<APPLET CODE=Simulator WIDTH=320 HEIGHT=230>
<PARAM NAME=practica VALUE=122>
<PARAM NAME=dibujo VALUE="practica1_2_2.gif">
<PARAM NAME=numentities VALUE=3>

<PARAM NAME=0title VALUE="variable voltage source">
<PARAM NAME=0type VALUE=1>
<PARAM NAME=0x1 VALUE=20>
<PARAM NAME=0y1 VALUE=50>
<PARAM NAME=0x2 VALUE=75>
<PARAM NAME=0y2 VALUE=115>
```

```
<PARAM NAME=1title VALUE="Ampermeter">
<PARAM NAME=1type VALUE=3>
<PARAM NAME=1x1 VALUE=65>
<PARAM NAME=1y1 VALUE=10>
<PARAM NAME=1x2 VALUE=130>
<PARAM NAME=1y2 VALUE=49>

<PARAM NAME=2title VALUE="Voltimeter">
<PARAM NAME=2type VALUE=4>
<PARAM NAME=2x1 VALUE=225>
<PARAM NAME=2y1 VALUE=40>
<PARAM NAME=2x2 VALUE=280>
<PARAM NAME=2y2 VALUE=125>

</APPLET>
</BODY>
</HTML>
```

Figure 4 : HTML circuit description file

The Laboratory Web Site

The design of the laboratory web site was very simple. Web Pages were created using a standard HTML editor. New circuits are easy to add to the Web. It is only necessary to write a HTML file with the name of the circuit image file and the description of the circuit components. The integration of this new modules representing virtual circuits was accomplished by establishing the correct link. In addition a booking mechanism was necessary because only one measurement can be performed at a time. To gain access to the measurement exercises the student must have a valid user account. This account can be obtained by sending a request to the webmaster. Although the user account allows full access to experiments, it is also necessary to have a time slot reserved. Booking guarantees that only one user has access to the device under test at a certain time. This prevents another user to access simultaneously to the same experiment.

The experiments available covers the basic topics of an electronics course:

1. Study of resistive and capacitive circuits: Ohm's Law, charge of a capacitor.
2. Diode characterization: Zenner diode, Light Emitter Diode (LED).
3. Polarization of Bipolar Junction Transistor (BJT): input and output curves
4. Metal Oxide Semiconductor Field Effect Transistor (MOSFET) characterization

The structure of each exercise is similar. The basic points are:

1. The goals and the basic concepts involved.
2. Circuit description
3. Step to step guide to perform the measurement set
4. Result analysis

All the information relative to the web laboratory is stored in our Web Server devoted to academic purposes. It can be accessed from: http://www.ii.uam.es~labweb/labelectr/indexLabE.html

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Evaluation

At the end of the course, the students were required to fill a questionnaire and to give their opinion regarding the use of the Web laboratory as a complement to the theoretical course.

The results showed the existence of minor adaptation problems. Learning how to use the environment application took less than half an hour to most student. Main suggestions were the need of having more available exercises and an unlimited time of access. Now, each exercise is available in a period of two-three weeks because of the limitation of the equipment in our real laboratory.

In general, we have obtained a very positive feedback from the students. The overall responses were positive and encouraged us to increase the development of new exercises.

Conclusions and Future Work

An online Web based laboratory as support for an electronics course has been presented. This laboratory is an ideal complement to a course that will be attended by Internet. A practical electronics course based on a virtual laboratory accessed through Internet shows the following advantages:

- It is possible to guarantee teaching suited to each student's skills, avoiding time and distance restrictions, eliminating labs at non preferred times and providing students the flexibility to take a lab at times they choose.
- Decrease the need for both equipment and lab space, thus potentially saving money.
- Decrease the requirement for teaching assistants in physical labs.
- The possibility of sharing lab experiences among universities according to the equipment available at each one.

Finally, it is important to remark the great universality degree reached by this kind of laboratory regarding to the unlimited number of users accessing through the web.

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"Intranets make Knowledge Management a Reality"

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Abstract:

Knowledge Mangement can probably be traced to the sighs of executives such as: "If our employees just knew what our employees know, we would be an excellent company".

This does indeed express one very important phenomenon: in every of organization of even moderate size there is lots of knowledge in the heads of people ("corporate memory") that is not only not known by others, but others don't even know that it exists. However, if such knowledge were available, lots of duplication, of problems when employees are sick or leave the organisation, much learning based on past experiences, etc. would be possible. Thus, techniques for collecting, nurturing and sharing knowledge are of increasing importance in just about any organisation.

In the world of the Internet with its variety of formats, lack of structure and missing or non-standardized meta data this is still a dream, but a dream that only in the very long run will become true. In closed Intranets, however, the situation is much more promising.

In this talk it is shown how information can be collected unobtrusively from persons in an organisation; how this information can be turned into knowledge; and how it can again be made available when needed, even in the absence of explicit requests from users.

More specifically, we will first show how and what kind of knowledge can be obtained from persons within an organisation without increasing their workload, how systemic actions can increase such knowledge, and how we can and have to move away from passive information system and passive data bases that work by request only to "active environments": in such systems, documents can answer any question asked, and information is provided on a personalized level when applicable without requiring requests by its users.

We mention a number of existing applications, mention a number of pitfalls, ways to overcome them. We also comment on the failure of some attempts and how minimalist approaches have saved projects in a number of cases where the "grand scheme" did not work out, e.g. because heavy employee resistance was encountered.

Using screen shots we prove that indeed active environments e.g. based on systems like Hyperwave (www.hyperwave.com) exist.
We conclude the talk by arguing that our society, not just individual organisations, will be changed dramatically as the tools for knowledge management keep increasing and that eventually life without knowledge management will become inconceivable.

PARTICIPATION OF WOMEN IN THE WEB DEVELOPMENT IN THE UNIVERSITIES: A CASE STUDY

Abstract:

This study makes an evaluation of the extent to which the escalation of the labour demand, the transformation of work culture and the diversification of the professional characteristics of the web profession have attracted women to enter into this new branch of IT occupation. It examines the role being played by the male and female workers in the creative, technical and management areas of web designing. It analyses the gender differences and similarities in the pattern of knowledge and skill acquisition in the web related technologies. Further it investigates the trends in the preconceived ideas of gender roles in the web based occupations.

1. INTRODUCTION

Web design as a profession is marked by rapid commercialisation and technical changes since 1995[1] and the demand for the web professionals is getting accelerated in the recent years both in the commercial and institutional sectors[2]. This new unexplored expansion of web work in the universities demands an evaluation of members participating in the web team of the university; the role and responsibilities of male and female participants in the web development; their professional and academic background; their training and exposure in the area of web designing; their motivation to entry into this new area of work, the nature of tasks they undertake in their respective departments and their overall contribution to the web project of the university. The aim of our study is to explore the situation of men and women in web designing in a public institution and to examine the extent to which this new technology breaks or reinforces the gender division of labour. It attempts to analyse the preparedness of men and women to take up technological route by taking into consideration of their educational, skill and training background. Further it tries to see the role of women as the designers or creators of this new technology rather than disempowered users of this technology for business, entertainment, and educational purposes. It also examines how far universities as public organisations foster equal opportunities for men and women in the field of web related works. In short, our study focuses its attention on women's participation in the web media from the gender technology and organisational perspectives on the basis of a case study.

2. OBJECTIVES

The specific objectives of this study are listed below.

(i) To identify the demographic and the organisational profile of the participants in the web environment in the sample university

(ii) To assess the situation of men and women in the working practices (web development, database management, graphic designing, server support, coding & programming, creation & maintenance of web pages, content development etc) and working environment (computer centre, administration, library, & academic departments/ faculties)

(iii) To explore whether there exists gender differences in educational attainment, skill equipment, and acquaintance with technological infrastructure (multimedia workstations, hardware & software).

3. METHODOLOGY

Our study focus its attention on the web designers in the University of Freiburg, Germany. An inventory of these workers were collected both from the Internet and also from personnel list maintained in the computer section of the university. The total population of the web designers is 156 among which male members are 128 and female members are 28. The entire web designers were contacted with a request for participation in our survey but only 58 of them expressed their willingness to take up our survey. Thus the participation rate of the respondents is 37 percent. Among those accepted to take up the survey, 45 are men and 13 are women. The period of the survey is April-May, 2001. The data are collected by contacting each one of the respondents in the various academic departments, administrative sections, library and the computer centre during their leisure time . A questionnaire covering aspects related to the demographic, educational and the skill profile of the male and female web professionals was used in the face to face interviews. It also included career related aspects such as motivation for the choice of this work, mode of work, assignment of tasks, nature of training, organisational environment, acquaintance with the technological infrastructure, career prospectus and the problems encountered. Data analysis was then carried out using SPSS6.

4. DATA ANALYSIS

In order to examine the various issues raised in the objectives, we have conducted a descriptive analysis of the data collected. As the size of the population of the male and female respondents of our study is unequal, both the groups are treated as a separate population in the analysis. The following section illustrates the status of men and women in the web environment of the sample university.

5. DEMOGRAPHIC PROFILE OF THE WEB DESIGNERS IN THE SAMPLE UNIVERSITY

The demographic pattern of our sample reflects that web team of the university comprises of largely male, young and highly qualified members. Despite the fact that web profession accommodates more women than

the other IT professions[3], we could notice from our sample that the representation of women in this area of work is limited. This might probably reflect the general trend prevailing in the university where the women population is relatively lower than their male counterparts in the IT occupations. As far as the age and academic qualifications are concerned, both men and women are on the equal level. This again reinstate the fact that the web team of the sample institution consists mostly of the youngsters with high academic background. It is generally argued that academic qualification is not essential for taking up web related jobs, but in the context of producing web content, the importance of the academic training as an 'add on' is realised.

6. ORGANISATIONAL PROFILE OF THE WEB DESIGNERS

The organisational pattern of the respondents reflects the web team composition of the major units (faculties, computer centre, administration, library and other centres) in the university. The size of the web team varies significantly among the different organisational units (faculteis = 57% , computer centre=12%, administration=12%, the library =10%) which gives rise to the argument that those units that engage more people, register greater progress than those that engage less people towards web based activities. The web team of the faculty of informatics and applied sciences is larger than the other faculties which is to some extent reflective of the availability of local expertise/human resources in these faculties. There are distinct differences in the distribution of men and women web professionals across the various units and faculties. There is no representation of women in the web team of the computer centre, while the participation of men are higher in this unit. Also, in units which are commonly considered as women's area of work like the administration and library, the web team members are mostly men. Within the faculties, men web professionals are seen largely in informatics while women are seen in applied sciences. The distribution pattern of men and women among the various units and faculties to some extent coincide with their subject background.

7. OCCUPATIONAL PROFILE OF THE WEB DESIGNERS

The occupational pattern of the web team (Table 1) consists of members from diverse areas of organisational (units/faculties)and occupational categories (job positions). Overwhelming involvement of professionals from all cadres and ranks may be due to the fact that to acquire skills in web designing is considered as an 'add on' for their professional development. This trend has marked the emergence of the new working culture in the university that necessitates the close collaboration of diverse professionals all working within a highly co-ordinated and structured development process in order to achieve the common cause of creation of the university web sites. Gender analysis reveals a distinct difference in the occupational background of the male and female members taking part in the web team of the university. Our sample shows that the web team composed of a larger percentage of men from the computing and the teaching occupations and women from the administrative occupations. The above result seems to support the assumption that web designing is receptive to men and women from both high-tech and non-high tech background.

TABLE 1 : OCCUPATIONAL PROFILE OF THE RESPONDENTS

A. ACADEMIC	M=14 (31%)	F=2 (15%)	**C. LIBRARY**	M=4 (8%)	F=1 (8%)
Professors	6 (13%)	1 (8%)	Section Heads	3 (7%)	1 (8%)
Associate Professors	6 (13%)	0 (0%)	7. Assistent Heads	1 (2%)	0 (0%)
Assistent Professors/ Scientific Assistent	2 (4%)	1 (8%)			
B. ADMINISTRATIVE	M=1 (2%)	F=7 (54%)	**D. COMPUTING**	M=26 (57%)	F=3 (23%)
			8. Team Leader	3 (7%)	0 (0%)
Associate Heads	1 (2%)	4 (30%)	9. Manager-IS	1 (2%)	0 (0%)
Assistent Heads	0 (0%)	3 (23%)	10 Coordinator IS	1 (2%)	0 (0%)
			11 System Administrators	7 (16%)	0 (0%)
			12.Web Professionals	7 (16%)	1 (8%)
			13. Student Consultants	7 (16%)	2 (15%)

8. KNOWLEDGE/SUBJECT BASE OF THE WEBDESIGNERS

Regarding the knowledge/subject base of the respondents, our analysis shows that in majority of the cases, women represent the non-technical group of the web team. The indispensability of the non-computer professionals in this occupation has been invariably noted from the studies. As web profession is both an art and a science[4], it involves both the creative (design) and the constructive (navigation, performance and administration) activities and therefore the need for specialists combining these two areas are required. It is noted from our sample that woman have a strong knowledge base in various arts, information science, social science and science subject background while men have background in the computing and allied subject fields indicating that the web team of the university has the necessary input for the creative and constructive areas of work.

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TABLE :4 SUBJECT BACKGROUND OF THE RESPONDENTS

S.NO	SUBJECT BACKGROUND	MALE	FEMALE	TOTAL
1.	Liberal Arts and Languages	2 (4%)	0 (0%)	2 (3%)
2.	Library & Information Science	2(4%)	0 (0%)	2 (3%)
3.	Social Sciences	13 (28%)	8 (62%)	21 (35%)
4.	Biological & Medical Sciences	2 (4%)	4 (30%)	6 (10%)
5.	Computer Sciences	18 (40%)	1 (8%)	19 (33%)
6.	Physical Sciences	9 (20%)	0 (0%)	9 (16%)
	Total	45 (100%)	13 (100%)	58 (100%)

9. TASK PROFILE OF THE WEB DESIGNERS

With respect to the work pattern of the participant in the web environment, gender equity is maintained. The representation of women is noticed in some of the traditional (technical) male areas of work like web implementation, creation of web based databases, web server support, and coding & programming (see Table 5). The representation of men in some of the women's area of work namely web page creation and content development is also seen. Though the male and female domains of work were well documented, the present study shows a slight deviation from the traditional role playing by men and women in their area of work. The presence of men and women are noticed in both areas of work and the gender differences with respect to the work domains are marginal (see Table 5). The roles or assignments of tasks taken by the gender groups give the impression that web development is neither a male's or a female's domain but it is a genderless area of work where both men and women with creative and technical knowledge could work.

TABLE: 5 TYPES OF TASKS UNDERTAKEN BY THE RESPONDENTS

SNO	TASKS	Male	Female	Total
1.	Web applications/implementation	4 (9%)	1 (8%)	5 (9%)
2.	Creation of web based databases	5 (11%)	2 (15%)	7 (12%)
3.	Designing graphics, animation and flash	3 (7%)	0	3 (5%)
4.	Web server support	6 (13%)	2 (15%)	8 (14%)
5.	Coding and programming	3 (7%)	1 (8%)	4 (7%)
6.	Web page development and maintenance	18 (40%)	3 (23%)	21 (36%)
7.	Content development	6 (13%)	4 (31%)	10 (17%)
	Total	45 (100%)	13(100%)	58 (100%)

10. SKILL PROFILE OF THE WEB DESIGNERS IN THE AREAS OF CREATIVITY, MANAGEMENT AND TECHNICAL WORK

An overview of the skill patterns of the respondents in the area of creativity shows that the concentration of majority of them seemed to be on a few areas of skills like creation of web pages and content designing. This convergence of attention on developing skills proficiency in certain areas can be viewed from two different perspectives: one is from the nature of the work (demand for work) and the other one is from the people involved in this work. As far as the nature of work is concerned, the universities are going in for a simple web sites that contain information in the form of texts and graphics (not flashy and highly technical). All those who know how to create and edit hypertext along with a basic knowledge of scripting (e.g. CGI, Java, perl, c and unix shell scripts) graphics application techniques (e.g photoshop, fractal painter and 3D modelling) and TCP/IP networking could perform the job of a web page designer efficiently[3]. Similarly, content creation requires both creative as well as technical and operational skills and it is stated that such skills could be acquired on the job. With respect to skills like animation, interface designing and illustration which requires a long training and practice most of the respondents have remarked that they cannot afford to invest their time on these areas since they are neither rewarding nor being considered as essential for performing their main job. In this context, it is worth considering the nature of the web development process in the university atmosphere. It is undertaken not as an exclusive profession of the staff and students, but it is taken as part of their other regular assignments. Probably that might be the reasons why the proportion of respondents having proficiency in certain skill areas which are on the high demand in the industry labour market like animation, illustration and graphic designing are only moderate in the university. The lower proportion of participants on the transferable skills (art directing, directing and video film production) suggests the diminishing demand for those skills in web designing since these roles have been taken up by the web designer. Considerations for the lay out, texts, images and graphics, determinations of the volume of digital information on a single page, the layers and sub layers, and the links etc governed by the web page designer. Therefore specialised skills in art direction and direction is not considered as important by the participants. Among the female respondents, invariably the percentage of women possessing some of the emergent (web designing-92%)and convergent (content designing- 85%) creative skills are higher than their male colleagues.

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Therefore, one could argue that women's expertise in certain creative skills in web designing help them to gain wider access to the web development.

With respect to the level of application of creative skills on current work by men and women, the latter seemed to score a higher level which coincide with the theoretical assumption that women are competent in the creative skills[6] and the artistic element required for web related works. It also seems to support the statement that 'the intellectual/creative arena' which forms the core of the web profession is 'becoming more of a level playing field'[7] and the web is considered as an equaliser and ideal medium for women to make progress[8]

Regarding women's proficiency in the managerial skills especially in the area of planning web sites confirm the general assumption that women score well as managers in the decentralised organisations where team work and delegations are considered as the key.[9] The lower application of the managerial skills in the areas of financial, advertising and copyright by the respondents could be justified on the ground that universities are still in the initial stage of the web development activities, and therefore, the need for holistic and strategic web production management skills may not be required at this juncture. As the skill requirement goes with the stage of web development, the need for people with specialised management skills may be required in the future. Gender difference is noticed in the pattern of skill development in the different managerial areas. Women seemed to show proficiency in the web planning and product management, while the male seemed to show efficiency in the areas of web promotion activities, copyright information management and financial management.

The higher score of male respondents in all the technical skill areas of web designing reconfirm the predominance of male in the technical areas of work especially in the digital media work[10]. Studies also have reported the lower visibility of women in the technical areas of multimedia and web industries. It is suggested that women's lower representation in technical areas is a result of the gendered nature of the prior industry practices in information technology and media production[11] In the present context, the lower representation of women in the technical areas may be attributed to the fact that majority of the female participants of this study are from the social science background (60%) and therefore their proficiency in the technical areas are relatively lower. However, programming skills alone is not the be all and the end all of this profession. It needs a proper blend of programming skills with sufficient proficiency in content development and production techniques. In that respect, women have the necessary skill base to participate as active agents in the web designing process. The general trend prevailing among the web industry is that technical skills can be acquired where as the creative skills are rare and it is considered as a scarcest resource. In summary, the skill profile of the respondents reveals that a fairly high proportion of men and women possess the skills needed to perform the work. The skill profile of the female respondents are higher in the creative (M=40%, F=49%) and management areas (M=28%, F=40%), while the male respondents are higher in technical areas (M=49%, F=34%) of work.

Table: Proficiency of the respondents in three major skills domains

S.No	Skill Domains	Male (%)	Female (%)
1.	Creative Skills	40%	49%
2.	Management Skills	28%	40%
3.	Technical Skills	49%	34%

The skill acquisition status of women in all the major areas of work gives the impression that they possess the necessary input to be an active agent in the web development in the university environment. The dominance of women in certain skill regions like creativity and management which are considered as the core areas of web designing makes one to assume that the scope of women to be the designer rather than just the user of this new technology are large. It is also reported that women seemed to have acquired a large share of the skills and characteristics relevant for the digital age[12].

11. GENDER DIFFERENCE IN THE PERCEIVED AND THE ACTUAL APPLICATION OF SKILLS

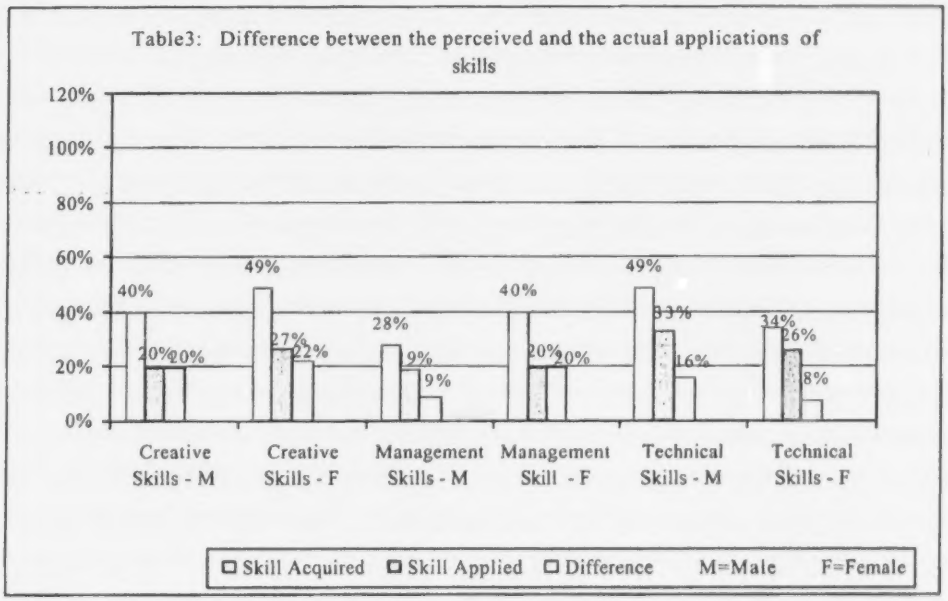
This study has also brought to light the difference between what the respondents perceive themselves to have skills in the creative, management, and technical domains and the level of applications (higher level) of those skills in their area of working.

It has demonstrated the difference existing between the skills acquired and the skills utilised in the field of work by the respondents. In the case of the female respondents this difference between the perceived and the actual use of the skill is very low in the technical skills while in the case of the male respondents this situation is found in the management skills. In all other areas of skills, the gap between these two phenomena is high for the male and female respondents.

The gap in the utilisation of the skills acquired by the respondents may be due to the lack of opportunity in the work area or due to want of time as most of the participants in the web areas of work are doing it as their

additional responsibility. It is presumed that as the web development project of the university is getting advanced/matured, the need for development and management of sites would become more complex, which might require full time professionals with specialisation in each branch of the web technology. In that context, the gap between the skill acquired and skill utilised would be narrow.

graph7: Difference between the perceived and the actual applications of skills



12. ACQUAINTANCE OF THE WEB DESIGNERS WITH THE IT INFRASTRUCTURE

The mastery in handling the technology and the familiarity with the hardware and software are considered as the essential parameter for the computing professionals. Tinkering with technology is one of the prime factors that determine the suitability of a person in the profession. This study has examined the level of acquaintance of the male and the female respondents in handling the multimedia hardware and the software associated with the web designing work. In the case of acquaintance with various workstations, a higher percentage of both male and female respondents have proficiency in handling windows 95 and windows NT. Gender difference is noticed only in the case of handling unix, in which case, the male respondents have higher proficiency than the female respondents. The same tendency is noticed in the case of handling the multimedia hardware where both the gender groups acknowledged a higher proficiency in handling flatbed scanner and the digital video cameras while the male members seemed to have gained high level expertise in handling the slide scanners. As far as the gender situation in the acquaintance with multimedia software is concerned, both the gender groups expressed a high level of acquaintance.

Gender Difference in Acquaintance with various Multimedia Infrastructure

Infrastructure	Male	Female
Workstation	Windows 95 (91%) Unix (80%) Windows NT (73%)	Windows 95 (85%) Windows NT (69%)
Hardware	Flatbed Scanner (83%) Digital Video Cameras (71%) Slide Scanner (60%)	Flatbed Scanner (85%) Digital VIdeo Cameras (61%)
Software	HTML Authoring (93%) Graphic Design (82%) Desktop Publishing (78%) Animation (64%)	HTML Authoring (85%) Graphic Design (78%) Desktop Publishing (85%) Presentation (69%)

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The above results makes one to assume that female members of this study are no longer technophobes and they have already acquired confidence in handling the technology with ease.

CONCLUSION

Our study shows that like in any other IT profession in Germany, women are under represented in web designing also. This lower participation of women might be due to the fact that the voluntary, unpaid and time consuming nature of the web designing job might be conflicting with the family and child care responsibility of women in the university. As this job requires constant learning and training, most of the women might find it hard to patch up with their already demanding commitments in their work and home. The findings of our study reveals that it is not the gender but the subject background of the individuals influences their participation in the web team of the various organisational units in the university. Women's absence in the web team of the computer centre and their lower representation in the web team of the administration and the library coincide with the lack of women professionals with computing background. Among the 50 percent of web professionals with the computing background in our sample only 5 percent are women. Since majority of the women have the subject background in science, their participation is visible in the web team of the biological sciences. It is seen from our study that the web development work requires both tech and non-tech professionals which encourages women with non-tech background also to get into this sphere of work. However, as the web matures, it would require professionals with more of technological background which could imply that the demand for non-technical professional is short-lived. A similar situation existed in the software industry during the 80s, when it was at the stage of infancy. As it advanced, it focused more on engineering and technological professionals rather than on non-engineering professionals [13]. It implies the technological orientation is required for women at a larger level to cope with the fast changing web media environment. Our study reveals the participation of women both in the creation web pages and in the implementation of the technologies signifying the equal opportunities prevailing in this work. Unlike in the software industry where there is concentration of women only in the bottom line of the occupational hierarchy, in web profession, the presence of women is seen in all job categories. Our study points out the gender difference in the skill development pattern of the male and female members. Men seemed to be proactive in developing skills in the technical areas while women on the creative and management areas. The most required skill demands for the web based occupations regardless of the industry segment are a combination of creative, management and technical talents for the next three to five years. In that context, women's opportunities seemed to be brighter in this occupation. The larger acquaintance of women with various computing platforms, multimedia hard ware and software gives the impression that they are no longer technophobes and prepare themselves to take the technological route with confidence.

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CROSSING ACADEMIC BORDERS
Integrating Interdisciplinary Learning with International Distance Education

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Introduction

California State University, Fresno (CSUF), one of the nation's largest Hispanic-Serving Institutions, in partnership with target high schools in California, Spain, Argentina, and Mexico, is conducting a multi-year, international, interdisciplinary distance education project called ***Crossing Academic Borders: Integrating Technology with Interdisciplinary Learning (CAB).*** Project CAB, which has been primarily funded by the **National Endowment for the Humanities**, with supplemental planning funds from the **W.K. Kellogg Foundation**, will be a model for new teachers who wish to use innovative technologies in social science and humanities curricula in order to reach students with extremely diverse ability levels and ethnic backgrounds as well as to involve students in project-centered research with their counterparts in other countries.

By March 2001, CAB will be nearing completion of its first year of development year in Fresno, with international schools ready to begin that summer. The presentation will cover a detailed review of the two-year planning process, the initial implementation, the challenges already faced and overcome, and the prospects for full implementation and project success.

CAB's project's title derives from the realization that contemporary learning requires teachers at all levels to cross several distinct and important borders. Intellectual borders divide academic disciplines; cultural borders divide students and teachers of diverse ethnic backgrounds; technological borders divide traditional pedagogy and the productive use of new technologies; professional borders tend to bifurcate university and high school teachers; and national borders divide in multi-dimensional ways. High quality distance educations programs hold promise to bridge these borders in exciting and productive ways.

The project's title also reflects fundamental elements of the three themes around which the content will revolve. ***The Immigrant Experience, The Hispanic World,*** and ***Steinbeck's America*** have been selected for several reasons: (1) their likely appeal to exceptionally diverse students and new teachers in all four countries, many of whom have first hand experiences which mirror those implicit in the focal themes; (2) the adaptability of those themes to multiple levels of educational proficiency and to many high school and college courses; (3) their importance to the study of world history and literature, U.S. history and literature, and numerous other subjects; and (4) their potential to serve as models for other schools in California, the United States, and other countries.

In addition to revolving around extensive on-line, international school partnerships relying heavily on project-centered learning and Internet interaction between students from several countries, CAB consists of summer institutes, technological training sessions, independent readings complemented by workshops and lectures throughout the school year, active involvement by teachers in developing self-paced, computerized instructional modules for each topic, and wide dissemination through the 23-campus California State University System and through national, international publications and educational forums.

The presentation will focus on several key areas as summarized below.

Need for the Project

This demonstration project addresses four related needs that have regional, national and international significance: (1) the need for curricular content; (2) the need to retain and retrain teachers; (3) the need for technology to improve

pedagogy through innovative and practical distance education, and (4) the need to build a strong bridge between high school and college teachers.

Need for Curricular Content –Social science and humanities courses, including history, government, sociology, literature, languages, and the arts, comprise well over half the courses required for high school graduation. They also comprise the preponderance of core course requirements in most colleges and universities. Consequently, focusing on these fields of study has the potential to affect extremely large numbers of teachers. Efforts to foster tolerance and appreciation of other cultures at high school campuses have often been limited to activities outside the curriculum: adding tacos or egg rolls to the lunch menu; celebrating Cinco de Mayo and Black History Month; including mariachis at school functions; and holding numerous "multicultural rallies." New approaches to both content and pedagogy are necessary in order to engage students and new teachers deeply in reading, writing, and thinking about the experiences and ideas that have shaped the complex civilization they have inherited.

Need to Retain and Retrain Excellent Teachers –The great majority of Central California teachers, including almost all the minority teachers, receive their undergraduate education and teacher training at Fresno State. Unfortunately, approximately one half of the new teachers, locally and nationally, leave the profession within the first five years. The problems of retaining and sustaining new teachers during the first five years in the profession and of strengthening links to scholars in the University after the credentialing year continue to be daunting, especially at a time of serious teacher shortage. It is far more cost effective to retain new teachers than to be constantly training new ones, only to have them leave within five years. Project CAB addresses two common problems of new teachers: isolation from the content of their disciplines and frustration teaching to an enormous range of ability levels and backgrounds.

Need to Transform New Technologies into Effective Teaching Tools -- Deepening the content knowledge of new teachers through interdisciplinary seminars and lectures conducted by recognized scholars is the first step of the project. The next step, technology training, will enable teachers to make self-paced computerized instruction modules for students of differing ability levels. Pilot high schools in the proposed project have generally adequate computer hardware and other technology on campus, but actual use of this enormous potential in humanities and social science courses remains minimal. In particular, there is significant promise in using computers to provide self-paced curriculum that enables students at all levels to increase their achievement. Computers are used widely in the military and in industry to provide self-paced instruction, but their potential in schools has yet to be realized. A common difficulty of new teachers is the problem of teaching to an enormous range of students, including many with limited English skills.

Need to Create Collaborative Relationships Between High School and College Teachers and to Utilize International Resources. There is a pervasive border between the world of high schools and the world of colleges and universities, which must be bridged if students are to be educated to their highest potential. Project CAB will bring together high school and college teachers over the course of a whole year in both formal and informal settings designed to foster collegiality. It will also enlist the collaborative efforts of educators from several counties working to develop common themes and distance education pedagogy.

Focus on Themes

The Immigrant Experience is the first theme of **Crossing Academic Borders**. All participating schools have immigrant and second-generation populations, and many new teachers are second or third generation Americans, including, but by no means limited to, Armenians, Portuguese, Southeast Asians, and Hispanics. New teachers have most likely taken courses in "multicultural issues," but such courses tend to be overly general, lacking in historical perspective, and without a firm grounding in primary sources. To design and implement this theme, participants are building pedagogical content knowledge about immigration, including international comparative immigration studies, for new teachers.

The Hispanic World is CAB's second theme. By 2020, Hispanics will be the largest racial/ cultural minority in the United States. In Fresno and the surrounding area, some schools have Hispanic student enrollment of between 96-99. A high percentage of Hispanic teacher education candidates come from these schools. Cultural and historic boundaries have been crossed and permanently altered by this dynamic demographic shift, yet secondary teachers and students currently have little knowledge about the Hispanic World other than local statistics and stereotypes regarding recent Mexican immigrants. To design and implement this unit, participants are studying key documents that illuminate the dispersion of Spanish culture and institutions in different New World countries and the interaction of Spanish, Indian, African, and other European cultures over time.

Steinbeck's Americas is the third theme explored in the project. High school literature teachers in the U.S., Argentina and Mexico frequently teach Steinbeck, the fiction writer who speaks most directly to California's place in history and in the American imagination. Participants in this seminar focus on The Grapes of Wrath, "The Pearl," and *Viva Zapata* as well as other works as they relate to broader historical realities, such as changes in agriculture, the development of the farm labor movement, and the arrival of more recent immigrants, including the Hmong, who continue to transform California agriculture. Participants will also explore how best to utilize digitized technologies to integrate supplementary documents, photographs, films, and other materials in classrooms and in self-paced computer learning modules for students of all ability levels.

Conclusion

Crossing Academic Borders can be considered something of a watershed for California State University, Fresno in part because it builds on some of the University's strongest assets – humanities and social science expertise, ability to train large numbers of teachers, and sophisticated technological experience and facilities -- and simultaneously responds to a convergence of fundamental needs that are having deep and widespread impact on educational institutions across the U.S. and the world, particularly those with rapidly escalating and highly diverse student populations. If they are to tap their full potential, teachers and scholars must grow in their knowledge of the academic fields they teach as well as how to incorporate interdisciplinary learning into their classes. They must also be provided with the tools to enhance and expand the horizons of student learning (and their own) using new technologies and distance education. If they are given these opportunities, they will grow in their capacity to teach. Similarly, university faculty need to stretch beyond campus boundaries, beyond narrow disciplinary interests and beyond the traditional student body if they too are to grow.

Crossing Academic Borders does not pretend to be all things to all people. Nor does it fall neatly into one simple category. Rather, it spans borders between academic disciplines, educational institutions in four countries, and technology; and it sets exceptionally high, but attainable goals. Because it takes risks, it is by no means assured of success, but if it is successful, it will be an important model to emulate.

The Role of Age and Efficacy on Technology Acceptance; Implications for E-Learning

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Abstract: As educational institutions continue to explore e-learning alternatives and as people continue to choose e-learning over traditional programs, additional empirically-supported research is required to understand the impacts and implications of e-learning. The objective of this study is to investigate the role of age and efficacy on computer usage behaviors and attitudes. The Technology Acceptance Model and Self-Efficacy Theory were used to guide the design of this study. 676 people of differing ages and backgrounds were analyzed. The findings support the validity and appropriateness of the Technology Acceptance Model and Self-Efficacy Theory for explaining computer usage in an academic setting. Furthermore, the results suggest that age plays is strong role in understanding computing behaviors and attitudes.

Introduction

Technological innovations are changing the landscape of employment. Entire job classifications are disappearing and new, more technologically sophisticated positions are being created. Furthermore, new work-related skills and knowledge are required for nearly every organizational position. Greenspan (2000) notes that these changes are so great that even the US Bureau of Labor Statistics failed to anticipate the dramatic impacts of technology on the workforce. Sadly, these changes are creating unprecedented levels of anxiety and insecurity among people about future employability. Despite having the tightest labor market in over a generation, people are more fearful of losing their jobs today than they were in 1991, at the bottom of the last recession (Greenspan 2000; Warr 1990).

In response to these anxieties many individuals are turning to formal education (Greenspan 2000). However, to balance the demands of work, travel, and family many people are exploring alternatives to traditional classroom educational programs. A relatively new and popular training alternative is e-education.

In 1998, the U.S. Department of Education estimated that 1.4 million people were enrolled in e-learning programs. The number of higher education institutions providing e-learning programs increased 33% between 1995 and 1998 offering approximately 50,000 e-learning courses. During 1998 alone, the number of schools providing e-learning options more than doubled resulting in an estimated 34% of all accredited colleges and universities offering e-learning programs (Weiss 2000).

Despite the popularity and growth of e-learning, little is known about its impacts and implications (Webster et al. 1997). Of particular interest are the criteria and characteristics that contribute to the success of e-learning. System success is often defined as the degree to which a system is accepted and used (Davis et al. 1989). Clearly, if the system is not used neither the institution nor the students will benefit. To understand and study system usage behaviors, several computer acceptance models have been proposed. One of the most influential and widely used models is the technology acceptance model (TAM) (Chau 1996). Igbaria et al. (1989) describe the TAM as not only one of the easiest to use, but also one of the most powerful computer usage models.

The TAM posits that if an individual believes that a system is useful and easy to use, he/she will use the system –thereby making the system a success. Within the e-learning context, for a system to be successful it must be used and it must foster learning. Therefore, in studying the success of an e-learning system, we seek to identify and examine those factors contributing to both system usage and learning. Based on the findings of prior research, we identified two factors of particular importance to both areas –chronological age and efficacy.

E-learning research is in its infancy (Webster et al. 1997). While initial findings suggest that individual characteristics may influence the success of the elearning experience (Grill 1999), no study has theoretically investigated the success of e-learning from an IT acceptance perspective. The objectives of the present study are to investigate the direct and indirect relationships among chronological age, efficacy, perceived ease of use, perceived usefulness, and system usage.

The conceptual model for this study, based on self-efficacy theory and the technology acceptance model, is described in the next section.

Conceptual Model And Research Hypotheses

Technology Acceptance Model

The TAM is based on "the cost-benefit paradigm from behavioral decision theory" (p. 321, Davis 1989). In general, the cost-benefit paradigm posits that human behavior is based on a person's cognitive tradeoff between the effort required to perform an action and the anticipated consequences of completing the action. In particular, the TAM asserts that a person will use a computer if the benefits outweigh the efforts in using the computer. The benefits are assessed by measuring the person's anticipated consequences (a.k.a., perceived usefulness; PERUSE) and effort is assessed by measuring the person's belief that using the system will be easy (a.k.a., perceived ease of use; PEOU) (Davis 1989).

H1a: Perceived Ease of Use has a direct effect on system usage.
H1b: Perceived Usefulness has a direct effect on system usage.
H1c: Perceived Ease of Use has a direct effect on Perceived Usefulness.

Self-Efficacy Theory

Self-efficacy is a measure of one's confidence that he/she is capable of accomplishing a task. Bandura (1997) argues that human behavior is primarily determined by a person's belief that his or her actions will result in positive outcomes (i.e., PERUSE) and that he or she is capable of accomplishing the activity (i.e., self-efficacy).

Human belief systems have been found to be enormously influential in psychology and MIS research. Bandura suggests that "people's motivation, affective states, and actions are based more on what they believe than on what is objectively true" (p. 2, 1997). Similarly, MIS researchers suggest that computer usage is affected more by behavioral influences than by technical factors (Webster et al. 1992). "Effective intellectual functioning requires much more than simply understanding the factual knowledge and reasoning operations for a given activity" (p. 18, Bandura 1995).

In borrowing self-efficacy from cognitive psychology, MIS researchers have defined computer-efficacy as one's general belief that he/she is capable of putting computer technologies to use (Venkatesh et al. 1996; Compeau et al. 1995). Empirical studies show computer-efficacy influencing: technology adoption (Igbaria & Iivari 1995), system usage (Compeau et al. 1995), system ease of use perceptions (Vankatesh et al. 1996), affective states (Igbaria & Iivari 1995), and computer training (Webster et al. 1992).

H2a: Computer-efficacy has a direct effect on system usage.
H2b: Computer-efficacy has a direct effect on Perceived Ease of Use.
H2c: Computer-efficacy has a direct effect on Perceived Usefulness.

Age

The implications and significance of chronological age has been well documented. Age has been shown to influence intelligence (Baltes et al. 1997), information processing ability (Sharit et al. 1994), job-related attitudes, work behaviors, values, needs, and preferences (Rhodes 1983), job satisfaction (Weaver 1980), changing psychological

needs (Gibson et al. 1970), outcomes, accomplishment, and extrinsic rewards (Rabinowitz et al. 1981), social pressure and influence (Hall et al.1975), memory (Floyd et al. 1997), attention-span (Plude et al. 1985), IT acceptance (Morris et al. 2000), abilities, traits, and performance (Sharit et al. 1994), task switching (Salthouse et al. 1998), adapting to change (Myers et al. 1992), resolving power in visual systems (Kline et al. 1982), learning (Mead et al. 1998), and finally, auditory and visual signal detection (Forteza et al. 1990).

H3a: Age has a direct effect on system usage
H3b: Age has a direct effect on Perceived Ease of Use
H3c: Age has a direct effect on Perceived Usefulness
H3d: Age has a direct effect on Computer Efficacy

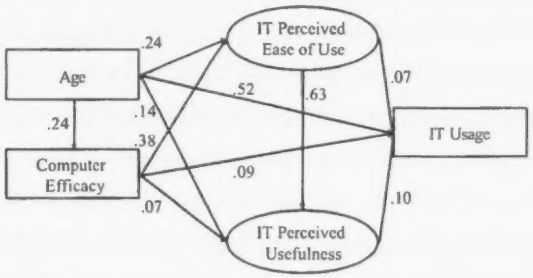

Figure 1. *Research Model*

Research Methodology

Sample and Procedure

The data for this study were collected using a questionnaire survey administered to high school students and to industry professionals. The high school is located in Philadelphia, Pennsylvania and the industry professionals worked for organizations throughout the continental United States of America. The survey was delivered to approximately 700 high school students and 700 industry professionals.

A total of 709 surveys were returned (51% response rate). Of these returned surveys, 33 were incomplete and were excluded from the data. In the end, 676 surveys were deemed usable, representing a final response rate of 48%. This response rate is more than adequate for the chosen data analysis procedure.

Data Analysis

The measurement of all study variables was adapted from prior research. Researchers have tested similar instruments and found the content validity and internal consistency to be satisfactory. The first stage of the data analysis is to assess and reaffirm the reliability of the measures used to operationalize the variables in this study. This involves assessing the contribution and reliability of multiple indicators for this study's latent and manifest variables. The tests for convergent validity, reliability, discriminate validity, and internal consistency were satisfactory. See (Tab. 1) for the results. The second stage of the analysis assesses the proposed conceptual model.

		Average Variance		Discriminate Validity				
	R^2	Extracted	Composite Reliability	Age	CEff	PEOU	PERUSE	Use
Computer efficacy	.06	0.51	0.88	.240	.717			
Perceived ease of use	.24	0.70	0.90	.331	.433	.838		
Perceived usefulness	.52	0.80	0.94	.364	.373	.706	.897	
Systems usage	.40	0.84	0.91	.605	.280	.355	.375	.918

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Table 1. Measurement Model Validities and Reliabilities

The variable path coefficients represent the total effect that the variable has on the other dependant or mediating variables. This total effect consists of a direct and an indirect effect on the dependant or mediating variable. The non-parametric jackknifing technique (Fenwick 1979) was used in conjunction with t-statistics to determine the statistical significance of the path coefficients. This practice is consistent with prior studies using PLS (e.g., Igbaria et al. 1997).

Results

Tests of the Structural Model

The results of the multivariate test of the structural model are presented in (Fig. 1). The tables show the path coefficients (i.e., standardized regression coefficients) and (Tab. 1) shows the R^2 (i.e., the explained variable) measures. The R^2 measures were significant to at least a p-value of .001, except for computer efficacy, which was not significant to .05. This suggests that the model sufficient explains perceived ease of use, perceived usefulness, and system usage. However, since we analyzed only one determinant of computer efficacy, namely age, we were unable to fully describe the construct. Since explaining computer efficacy was not an objective of the study, it does not impact the findings.

Consistent with hypotheses 1a and 1b perceived ease of use and perceived usefulness significantly effect system usage ($\beta = .07$ and $\beta = .10$, all p-value < .001). Consistent with hypothesis 1c, perceived ease of use influences perceived usefulness ($\beta = .63$, p-value < .001).

Consistent with hypothesis 2a computer-efficacy significantly effects system usage ($\beta = .09$, p-value < .001). Consistent with hypotheses 2b and 2c, computer-efficacy influences perceived ease of use and perceived usefulness ($\beta = .38$ and $\beta = .07$, respectively, all p-value < .001).

Consistent with hypothesis 3a age significantly effects system usage ($\beta = .52$, p-value < .001). Similarly, consistent with hypotheses 3b, 3c, and 3d age significantly effects perceived ease of use, perceived usefulness, and computer efficacy ($\beta = .24$, $\beta = .24$, $\beta = .14$, respectively, all p-value < .001).

Discussion

This study integrated the theoretical perspectives of self-efficacy and the technology acceptance model as applied to computer acceptance within educational settings. Furthermore, we investigated the role of age on influencing key acceptance factors such as computer-efficacy, perceived ease of use, and perceived usefulness.

The conceptual model and hypotheses were tested using a structural equation modeling technique, partial least squares.

The results support the use of the technology acceptance model and computer-efficacy within an educational domain. Furthermore, the results indicate that age has a significant direct effect on usage and on the mediating variables (computer-efficacy, perceived ease of use, and perceived usefulness).

Inconsistent with the TAM, which posits that external variables (i.e., age) will influence usage primarily through the mediating variables, age had a very significant direct effect on usage. This anomaly may imply that people are simply required to use computers more as they progress through school and once they enter industry. However, this is unlikely since age has a positive relationship with all variables. The data suggests that people's attitudes and usage increase as a result of age.

Conclusions

This study represents a very early step towards theoretically explaining and empirically testing the role of attitudes on accepting technology within educational settings. The implications for this line of research are far-

reaching. Based on the results of this study, it appears that age influence the acceptance of technology. If future research is able to validate these findings, elearning priorities, implementation plans, and e-learning objectives should be adapted. Of particular concern is whether elearning will discriminate against people based on their biological age. If this is the case, when moving towards e-learning, educational institutions should design different programs for different age groups.

The research design employed in this study was a cross-sectional analysis. While this is typical for survey-based research, the directions for the casual linkages are unknown. As a result, it may be that technology usage develops improved attitudes towards technology rather than visa versa. Longitudinal research can be used to determine the direction of causality. However, regardless of the direction, age is still a significant factor.

The results of this study support using the TAM and computer-efficacy within an academic setting. However, inconsistent with the TAM, age (an external variable) was the single largest determinant of technology usage. Furthermore, the findings presented in this report provide strong support for additional theoretically-oriented, data-supported research within e-learning, in particular the identification and integration of additional external factors (i.e., attitudes and environmental considerations) that influence IT behaviors within an educational setting.

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Critical Thinking and Hired Education:
The Need for Life Long Learning

According to the Lisbon European Council which met in March, 2000

> The European Union is confronted with a quantum leap stemming from globalization and the new knowledge-driven economy." <And the strategic goal is> to become the most competitive and dynamic knowledge-driven economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion. [1]

In order to do this the council concluded that:

> European education and training systems will need to be adapted to the demands of the knowledge society, and to the need of an improved level and quality of employment. Schools, training centres, enterprises and research institutions will need to enter into mutually-beneficial learning partnerships. [2]

With this in mind, the stated objectives of Objectives of "eEurope 2002, An Information Society For All" include

1. Providing young Europeans with good facilities (computers, communication connections) and up-to-date teaching material and teachers required to prepare the young for living and working in the digital era.

2. The promotion of employees' knowledge and skills... by means of courses and lifelong learning, and the adaptation of the organization of the workplace to the digital era.

3. The prevention of the exclusion of groups from the information society. Special attention will be devoted to groups at risk of falling behind, such as the elderly, the poor, and the disabled. [3]

Actually, these three 'motherhood' statements aren't very controversial, the fun will begin when the various factions try to determine the best implementation strategies. For our talk today, I'd like to discuss the underlying theme of these three statements which is the convergence of life long learning and learning on line. As well, I wish to discuss this theme from two seemingly different standpoints. The first is as a practical professional who trains faculty to use informational technology to enhance course development and delivery. The second is as an academic concerned about the pressures from outside forces that demand concrete answers to the question 'What specific task related skills do you give students so they can get a real job'? What I suggest is that the practical, corporate world's concerns will be best met by realizing what it is academics provide to their students.

Clearly, the importance of Life Long Learning is linked with the economic progress of the individual and the State. It is also important for promoting professional, personal and social interests and skills. Simply put, but often forgotten is that learning makes us better human beings. But there are hurdles that Internet users must overcome. And that's where the role of educators comes in.

To meet these aforementioned objectives which range from the purely instrumental to the purely intrinsic, people will need to (a) have access to information technology and (b) know how to use information technology effectively.

Life long learning is required as developments in technology increase and as the rate of change in technology speeds up. Accordingly, the professional skills that students learn today may not be of use to them when they complete their degree two years from now. What people are hired to perform today may change tomorrow. How many people have had their job descriptions if not their job titles changed over the past few years. It all began when you were asked to do a little task 'off the side of your desk' when you had a spare moment to when you de facto found your current responsibilities are nothing like what they were. This is often not done by design but by accident. For example, nine years ago I was hired as at the University College of the Cariboo to teach philosophy, specifically medical ethics, and I still do. However, within the first year of my being there, our Vice President, who knew I was already incorporating the Internet into my courses, got wind of this and I was soon looking after our Distributive Learning Initiatives including some 1000 hours of Interactive Television per year.

One of the world's largest video game developers with sales over $300 million US per year provides us with a perfect example of the need for life long learning. This company's Research and Development seeks out the best programmers and forms university-business alliances or streams by developing co-op programs to intern the best and the brightest. But by the time the students come to them, the computer languages that they have mastered may already be on the way out the door. Ever noticed, how $100.00 computer language books are available for $9.95 just a year or two later? The same goes for the employee who can master particular computer code but doesn't know how to learn anything new. More important than just hiring the best technical specialists to fill a particular job description, this software company looks for programmers who also have some general university background. English and Anthropology are as relevant as Java and SQL. Why is this? The answer is obvious.

Since you can't teach what hasn't already been conceived of, employees have to adapt and respond to the latest computing developments. Sure, we can teach people about 'ghosts, and UFO's' and other things that don't exist (they don't right?), but we can't teach people how to write programs for software and hardware that has not been dreamt of yet. A general liberal education offers students training in that non-quantifiable area known as 'critical thinking'. In any number of courses, from Anthropology to Zoology you must develop communication skills, writing skills and thinking skills. For whether you are trying to decipher a poem, investigate a historical event, or explore the human psyche, your are learning how to interpret and analyze, how to participate in abstract reasoning, how to conduct research and how to synthesize your results.[4] All of which are all talents that are required of us in the information age.

In regards to hi-tech training, we can give people the particular skills necessary to sit in a cubicle and occupy office space, but like the highly underrated film of the same name, what you may be creating is an employee whose life centers around hand to hand combat with the photocopier machine. [5] Furthermore, if we just teach technology skills to our students and feel our job is done when they graduate, then this "Teach them and leave them" attitude will limit the person's ability to continually contribute to the economy as an employee or employer, or to the country as a citizen. And as we move into the fourth stage of computing this issue will become even more pressing.

The fourth stage of computing is 'ubiquitous computing' where many computers share each of us; computers are imbedded in our furniture, clothing, cars…everything. [6]

We're beginning to see this ubiquitous Computing or what Mark Weiser called "Calm Technology" flowing over and through us. [7] Some of us will ride the crest of the wave, while others will drown – and perhaps because drowning has been characterized as a peaceful death that this trend is called 'calm' technology.

The separation of the *have-nets* and *have-nots*, those who ride the wave and those who don't, is the so-called digital divide. The problem with the digital divide is that it creates an imbalance of knowledge. And with this imbalance comes an imbalance of power. Those who have access to the Internet, shall get more: More information, more knowledge, more opportunities, more autonomy. While those who do not have, shall struggle. It is these concerns that lie behind the eEurope goals. But is learning online all there is to the equation?

For students, learning used to be easy. You'd attend class, take notes, write the essay or exam and the course was done. Students now use email to write their instructors questions or submit assignments, they search the web for more resources, participate in online discussions and more. While some people may see this as new (and this is where we hear cries of how the lecture mode of university teaching needs to be forgotten), you'll note that we seldom hear about whether the students really want to or have the time to explore these 'educational enhancements'. At its core, distributive learning now often reflects the true nature of learning, traditional lecture just happens to be one way we've motivated students to do this learning. Today's good students do more than just sit in class and smile and nod, *and they always have*. They are the ones that have always taken on the responsibility to learn and to be more self-directed in that quest. Learning is an ongoing, personal process. It doesn't end when the lesson ends; it doesn't end when the student graduates. If modern technology can encourage more students get involved in this process, great, but if the students don't know how to use these educational enhancements then there are more productive things that they could be doing instead of searching the Web looking for essays to download.

In order to promote effective life long learning, having Internet access obviously presents us with an incredible opportunity to reach the masses. However, the answer isn't just more computers or more infrastructure because simply having access to information is useless or dangerous. One must have *informed* access. And because we can't be with our

students every day, and because we can't be with them when they leave our institution we need to move them from just learning content to learning how to learn.

As technology widens its circle of influence for good or ill, a person's critical thinking skills are going to be called upon more and more. People need to be able to tell the difference between information and misinformation, the truth from the lies. They need to be able to analyze, evaluate, criticize and defend when presented with new ideas and concepts. – All things that they learn directly or indirectly in a general education program.

False historical, medical, political information, fake online commerce sites (e.g., banks), websites for nonexistent cities – are all potentially dangerous to those who have computer access but who do not have critical informational interpretation skills. For example, if a person wanted to learn about the whitehouse, the minor differences between web address of whitehouse.gov, whitehouse.com or whitehouse.net will soon be apparent.[8]

Part of the reason why people are feeling like they are being left behind is that we create jargon and new ('buzz') words to capture the moment as technology advances. We use old concepts to comprehend the new ideas yet the moment passes almost as quickly as MicroSoft releases a new Update (or 'fix'). More seriously, these buzz words can create the perception that what is 'new' is special, different, and somehow better and brighter than the old. Consider the buzz around e-banking and e-commerce which aren't really 'things' but processes. Banking is banking whether I talk to a real person who manually fills in my bank account card or whether I go online. Commerce is what I do – in this world or the virtual one. The rules of old commerce still apply to e-commerce and this was a hard lesson for investors in dotcom companies to learn. And speaking of learning, e-learning is no different from learning; or shouldn't be…We don't say "Today I'm doing book learning (b-learning), tomorrow lecture-learning (l-learning), then e-learning." I'm just banking, consuming or learning – regardless of the method of delivery.

Thus in response to people who as us what skills we are giving our students for them to face the new world, the song remains the same. The development of digital technology and new media simply re-enforces our need to acquire knowledge. This new technology puts pressure on those of us at the front – educators, business and community leaders to make sure that as the 'ripple' of ubiquitous computing spreads, that we bring along the rest of humanity with us. General education teaches critical thinking skills, flexible and adaptive techniques. Employees need these skills to respond to new technologies that don't even exist when they are hired. Life Long Learning and Life Long Learning Online are central to this goal of promoting specific employable skills as well as learning how to learn. As Eric Steinhart says: "*Thinking* is the most valuable skill in a post-industrial economy. No wonder philosophers are doing better and better."[9]

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1 Presidency Conclusions Lisbon European Council 23 and 24 March 2000 http://europa.eu.int/council/off/conclu/mar2000/mar2000_en.pdf

2 Lisbon European Council Goal 3.9.1.7

3 eEurope 2002 An Information Society For All Action Plan prepared by the Council and the European Commission for the Feira European Council 19-20 June 2000 3.9.2.2 http://europa.eu.int/comm/information_society/eeurope/actionplan/index_en.htm

4 These categories are those captured by Eric Steinhart "How Philosophy Pays Off", 1998. http://www.wpunj.edu/cohss/philosophy/PAYOFF.HTM

5 Office Space, written and directed by Mike Judge, 1999

6 The first three stages of computing are 1.Mainframe - many people share a computer 2. Personal Computer - one computer, one person 3. Internet - Widespread Distributed computing.

7 The Coming Age of Calm Technology Mark Weiser and John Seely Brown Xerox PARC October 5, 1996 http://www.ubiq.com/hypertext/weiser/acmfuture2endnote.htm

8 www.whitehouse.com is a adult sex site, www.whitehouse.net is a spoof of the authentic www.whitehouse.gov site

9 Eric Steinhart "How Philosophy Pays Off", 1998. http://www.wpunj.edu/cohss/philosophy/PAYOFF.HTM

Statistical, Graphical and Numerical Javabeans for Web-Based Distributed Application Development

Abstract

The authors have developed a few components or Beans (most commonly used ones) as a general-purpose web-based toolkit for numerical, statistical and graphical analysis. The toolkit is developed using JavaBeans, in a modular or component form, very similar to concept of subroutines. JavaBeans is implementation of Java but as component software or "Bean", which can be used over and over again by various applications on or off the web. More components can be easily added and the toolkit can be expanded as newer reusable and distributive applications are identified and or developed. These components and other software components (developed by other researchers) can also be assembled using visual application builder tools available from independent software developers. All the above programs or components are modules, which any one can use or call or include within their application by just passing the needed parameters, just like one would use or call a subroutine, the only difference being, it can be done on the web across several continents The paper will present these numerical, graphical and statistical analysis "beans" and demonstrate their reusability in web based courses like Statics and Dynamics and in Web-Based Virtual Manufacturing Environment.

1. Introduction

Every university, industry and government organization is talking about developing web based applications, using text, multimedia, 3D, interactive, virtual and what not. There are hundreds, if not, thousands of tools available for numerical and statistical analysis, ranging from $50 to $5,000. Faculty developing web-based engineering applications always needs numerical analysis modules and graphical results display tools. They also have to integrate these tools into their research applications or on-line courses. It will be very convenient for the developers to be able to easily access these tools on the web and integrate them into their applications, whether it is for research or teaching. Beans automatically inherit all the characteristics of any other Java program which include object-oriented, platform independent and relatively secure applications plus the additional feature of being reusable, reconfigurable and distributed provided by JavaBeans. JavaBean components can be called across the web or can share and pass data within several distributed applications. One can create distributed applications by running one chunk of a JavaBean component on one computer and another chunk of that application on another computer in some other part of the world. JavaBean components are optimized for distributed application across the Internet and thus can very easily communicate with CORBA (Common Object Request Broker Architecture) which is becoming an industry standard for developing distributed application or OBR's (Object Request Brokers).

JavaBean component can also be used by Microsoft's ActiveX component using the bridge. A bridge is a program, which translates ACTIVEX API calls into corresponding JAVABEAN API, calls in a transparent fashion. JavaBeans model is an extension to the Java language that enables one to create a special kind of Java program called Java component or 'bean'.

2. Design and Development

Initially the following components are being developed as part of the tool-kit.

[1] Numerical Analysis
- Matrix manipulations
- Solution of Linear Algebraic equation using LU decomposition
- Solution of ordinary differential equations by RKF45 (Runge-Kutta-Felhberg technique)
- Solution of Stiff Differential Equations using the Gear Method
- Cubic Splines for data fitting and interpolation

[2] Statistical Analysis
- Measure of Central Tendency (Mean, Variance, Median)
- Probability Distribution (Binomial, Normal, Gaussian and Poisson)
- Analysis of Variance
- Regression Analysis
- Factor Analysis

[3] Graphical
- XY plots
- Bar Charts
- Pie Charts
- Rotation about an arbitrary axis in 3D

[4] Unit conversion
- SI Units, English Units
- Special Units

Beans will not only be able to interface with any other Java program or any Java supporting platform, but will also interface to relational databases and CORBA-complaint ORB's (via IIOP), OpenDoc components, Netscape plug-ins, and Microsoft's ActiveX components. Old legacy applications, which were developed for the mainframe can be interfaced to the beans, thus making it discipline and application neutral also. For example, if one looks at fundamental engineering courses or some physics or math courses, they all deal with developing the governing equation to solve a certain problem. The differential equation has to be solved (in most cases) numerically. The Runge-Kutta-Fehlberg (RKF45) component can be used by all those courses by just passing the differential equation to the RKF45 bean/component. In most of those courses, the instructor does not have the time or scope to teach students how to solve the differential equation. In some cases the students might use a very simplified, inaccurate technique to solve the equation and get results, which are way off from the actual behavior. Since the components using JavaBeans are web based, the students can use it from their dorm rooms, or off campus. If the instructor wants to develop his/her course on the web, he will be able to use the RKF45 component transparently and would have more time to concentrate on the course itself, developing the governing equation, instead of figuring out how to solve that equation (which is also needed). Once the results are generated using the numerical analysis tool, the graphical components can be called to visualize the results, again on the web. The student can develop the equation on a different computer, numerically solve the equation on another server (fast server for number crunching) and display the results graphically on a third computer (*illustrates the beauty of component based software*).

The same graphical components to plot XY plots, bar charts or pie charts can be used by the Psychology department, or the Speech and Hearing department or the Education department or Biological sciences, after analyzing the data using the Statistical components to perform Regression Analysis, or Analysis of Variance. At the same time, the interpolation component can be used to fit the data, before plotting it. Again, all these tasks can be done just by calling the appropriate component in the tool-kit from their course related web pages.

The above two examples are just a few scenarios from a few hundreds, which demonstrates the re-usability of component-based software, the time savings for faculty developing web-based courses by being able to use the tool-kit, and thus a cost savings for the university. Since it is component or subroutine it can be called or used by other Java applications or JavaBeans applications. Figure 1 shows the front end of the tool-kit.

3. Conclusion

The most widely used components have successfully been developed. The componenet/beans were used in the Statics, Dynamics courses and Virtual Manufacturing web environment to solve differential equations,

plot graphs, and convert units. The use of the tool-kit is enormous due to its reusability, distributed and ease of use features.

4. Acknowledgement

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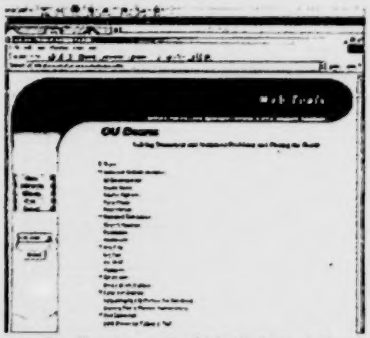

Figure 1: Front end of Web-based Tool-kit
http://www.ent.ohiou.edu/~comtool (click on OU Beans)

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Development and Assessment of Interactive Web-based Problem Solvers in Reinforcing Math and Physics Concepts

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The paper details the experience the author has using Problem Based Learning (PBL) approach in teaching the fundamental mathematics and physics concepts in one such course, "Hearing Science" in the Hearing and Speech Science (HSS) department. Hearing Science is a core course required by the HSS department. It is one of the fundamental courses and a foundation for the advance courses like Psychoacoustics, Physiology of the Ear, Audiology, Pathology of the Ear, Speech Science, Speech production etc. The course entails trigonometric (sine), and logarithmic functions, sound physics, anatomy, physiology, and psychoacoustics. Since the students do not have the prerequisite background in math and physics, the instructor in the past either skipped the concepts which are very critical in understanding and synthesizing details of hearing science like cochlear implants, hearing aids, instrumentation used in the clinic, or the instructor has to spend time in teaching the basic mathematical and signal processing concepts and cannot cover the actual hearing science material planned for the course during that quarter. By developing web-based problem solvers to graphically and interactively let student explore and learn the concept of unit conversion, signals, wave models, and psycho acoustic correlations, student can learn these concepts at their own pace and time, which serves as a starting point for acquisition of new knowledge. Students can review the material anytime from anywhere as long as they have access to the WWW and can go through as many examples/sessions as they need to master/learn those concepts. PBL approach helps create learning through experience and the reinforcement of existing knowledge. It provides a means of integrating new information in the context of the learning process and the students are actively engaged in their own learning when they are making decisions about the advance theory. Using problem based approach students can apply new and existing information easily to new problem resolution. Since the learning outcome of the Hearing Science course depends largely on synthesis of diverse areas like mathematics, signal processing, acoustics, anatomy, physiology, and psychology, developing a web-based PBL approach for the fundamental concepts proved to be a successful tool for the students in grasping and synthesizing the hearing science material in one quarter.

Student Success in Web Based Distance Learning: Measuring Motivation to Identify At Risk Students and Improve Retention in Online Classes

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Abstract: This study demonstrates the relationship between student values and commitment in the environment of California community college web-based instruction. It provides evidence that student motivation can be ascertained in the first week of class and is a strong indicator of "at risk" status and later dropout. A recent model of Motivation, from USC's Human Performance Technology Program, has suggested that task values have an influence on student choice behaviors. Correlations obtained in this study demonstrate that students who have high task choice values may be expected to persist in a class. Gender, ethnicity, subject, level of prior English classes, or ESL did not influence persistence in the class. It was found that students with low task values, low prior grades in English, and older students (over 28 years) may be more likely to drop out of a class that is completely web-based, and that this can be reliably measured.

Introduction

In California Community Colleges, Internet delivered instruction is proliferating with the explosive growth of the world-wide web, the conversion of business to knowledge based economy, increased student numbers and use of the internet, competition and limited resources, according to surveys conducted in 1999 and 2000 by the US National Center for Educational Statistics (NCES) Primary Research Group (PRG) and (NCES, 1999; PRG, 2000).

Community colleges enroll 10.4 million students annually, and award over 600,000 AA degrees and certificates (California Chancellor's Office, 1999). Students enrolled in Community Colleges represent 44% of all undergraduates in the United States (NCES, 1999). In California by 1998, the number of students involved in distance learning classes that used Internet delivery tripled from a year before. By the 2000 - 2001 academic year, estimates of the number of students enrolled in web-based distance learning classes at California community colleges were set at 40,000. (CVC, 2001).

Adult education and training are multi-billion dollar industries, and new industries are being created to offer training at a distance. (Ko & Rosen, 2001; Kearsley & Marquardt, 1999) Web-based distance education provides an opportunity to save costs in travel, housing, building new schools, and instructor salaries, while offering the potential for self-paced, anytime, anywhere dispensing of learning.

There is an expectation that computers are superior cognitive tools and that employing them will improve instruction (Moore, 1990; Clark & Verduin, 1991; Jonassen, 1996; Sugrue 1998). But performance has not met the expectations of this medium (Bork, 1997). This may be because there is a considerable gap in the understanding of many educators about the basic elements necessary to support learning, and the role computers play (Clark, 1993).

At Foothill Community College, a 1997 survey showed a 20% attrition rate for regular classes and a 50% attrition rate for classes offered at a distance (Mendrinos, 2000). These results are consistent with some findings for distance learning classes at other institutions (NCES, 1999; Primary Research, 2000). Student engagement, motivation and environment are the areas where students have the most problems in this type of course delivery (Moore, 1990; Kember, 1990; Iverson, 1995). The success of web-based distance education will depend on many factors, but it must meet the specific motivational requirements of learners to be viable.

If a majority of students are to be served in online instruction, the high rate of attrition in distance learning classes will need to be addressed. A first step towards solving this problem is assessing what profile of student can be expected to succeed or fail in web-based instruction. Once this is known, the information can be used to predict outcomes and provide solutions.

The Study

The purpose of the study is to examine student motivation and drop out behavior. The ostensible reason for looking at this question is to find measures that may, at the onset of a class, suggest which students might be at risk of dropping or failing the class. If the degree of motivation a student holds for the class may put them at risk for non-completion or failure, appropriate intervention strategies may be designed to assist the student in a timely way and with a greater likelihood of success. Social cognitive models of motivation propose that self-beliefs and self-regulatory processes are important in explaining how an individual accomplishes a task in a specific context. Learning, motivation and environment all play prominent roles in an individual's perceptions of a learning task (Pintrich & DeGroot, 1990; Clark, 1997). Drawing on the USC Cohort CANE Model of Motivation (1997), this study will serve to establish the relationship between the variables of task value and task choice in classes that are wholly provided by web-based distance learning. It will examine the level of task values students hold for classes and compare their performance with this measure. The study will also consider if demographics have a relationship to students' decision to stay in a class, in order to determine if there is a particular population of learners who is "at risk" in this learning environment.

Although some studies have looked at the effects of task values on choice behaviors there appear to be no known studies that look at the ability of task values to predict task choice in web-based classes. Moreover, early studies of commitment (task choice) and achievement, have viewed task values as a moderating influence effecting effort and indirectly effecting achievement (Eccles, 1983; Greene, 1999). Very few studies have considered that task values may have a direct influence on task choice or achievement. This may be because earlier theory and studies assumed task values were not separate variables (Eccles, 1995). A number of researchers have recommended investigation of the predictive possibilities of task values for various behaviors (Eccles & Wigfield, 1995; Greene, 1999; Lin, 1999).

Several recent studies have examined task values influence on commitment and goal orientation. Some of these studies indicate that task values may directly influence task choice, commitment and achievement (Lewis 1997, Lin 1999, Greene 1999). Task values may be a "missing ingredient" that is not being measured or considered in studies of student motivation, beliefs, commitment, and achievement. They may explain confounding results obtained in other studies of variables know to influence performance such as effort and self-efficacy.

PERSONAL AGENCY Efficacy Context	X	EMOTION Mood	X	VALUES Utility Interest Importance	=	COMMITMENT (Task Choice)

Figure 1. CANE (Commitment And Necessary Effort) Model of Task Commitment. Clark (1997)

This study is a survey that examines students' Interest, Importance and Utility in two different social science classes: political science and general psychology. Four 7-response likert scale questions were developed for each of the subscales, Importance, Interest and Utility. Additional dichotomous and categorical questions were developed for personal variables in order to consider the effects of demographic variables on the subjects' responses. These personal variables included student experience in prior online learning classes, prior grades and courses in English, ESL, age, gender, and ethnic identity.

The survey was directly e-mailed to students in the two classes. Out of 150 possible subjects, 59 responded representing a sample size of 39%. Subjects' responses to the survey were collected the first week of class. Subsequently, data was collected again at the fifth week of class to determine student retention. This information was obtained from the college admissions records, verifying continued student enrollment beyond the school drop date.

The survey looks at three specific aspects of Task Values: Interest, Importance and Utility. There are four questions for each of these constructs to comprise each sub-scale of Task Value. A 7-point Likert scoring scale was used with

the choices given ranging from "not at all" to "very much" After the 12 questions about task value, there were 8 additional questions about demographics, online experience and English skills. These questions allowed the respondents to choose dichotomous or categorical answers. For example, "Is this your first online class" (Yes)___ (No)___. Another example of a question, "I obtained a grade of ____in my highest level English class, (indicate A, B, C, D, or F)".

Personal variables were analyzed in terms of frequencies, to support the assertion that the sample's study results can be generalized to the total population of adult learners. The reliability of the measures of interest importance and utility were calculated. An item analysis statistics was done for the three components of task value; interest, importance, and utility (Eccles, 1995). These measures were correlated with the student's enrollment in the class at the fifth week (following the decision point for dropping the class). Next correlations were made for all variables. Finally, a factor analysis was made to determine the integrity of the variables for the three components of task value (importance, interest and utility).

Results

The survey data were collected and evaluated to determine if there is a relationship between Task Values and Task Choice. Out of a population of 150 students 59 responded to a self-report survey, which represents a sample of 39% of the total population. Considering the means of the demographics of this study, for the 59 survey participants, the results indicate that the majority of students were not taking their first online class, were not ESL, had college level English with a B or better, were female, white and did not drop the class. They also showed high levels of interest importance and utility.

There was three task value scales: importance (IMP), interest (INT), and utility (UT). There were four items for each scale in task value, to comprising 12 items to constitute the construct task value construct, as defined by Eccles and Wigfield (1995).

A test of the internal consistency reliability (Cronbach's α) for the task value scales was conducted. The results of the test for reliability are shown below. Task value scales obtained alpha coefficients (α from .81 to .86). The customary criteria for reliability is an α value of .70 or higher. These results suggest that the measures of task value: interest (α .8124), importance (α .8490), and utility (α .8686) are highly reliable measures. The measures, which were adopted from Eccles and Wigfield's 1995 study, are shown to be reliable measures in the population of adult learners in a web-based class. These results are consistent with other research (Green 1999, Lin 1999, Blair O'Neil & Price, 1999).

Cronbach α for the Task Value Scales

Task Value	α
Interest	.8124
Importance	.8490
Utility	.8686

Figure 2. Reliability of the Task Value Scales (Cronbach Alpha)

Correlational Analysis of all Variables

A correlation analysis shows that there is a positive correlation between the constructs of Task Value and Task Choice. The results indicate a positive correlation between subjects who remained in the class past week 5 (choosers) and the construct of Task Value. Similarly, there is a lower correlation between subjects who do not remain in the class (non-choosers) and Task Value. Correlations between students with high Importance Interest and Utility and students who chose to dropout were significant at the .05 level (2-tailed). This means that students who dropped the class by week five had demonstrated low task value in at week one. Conversely, students who demonstrated high task values in the first week remained in the class at week five. This is a significant finding and clearly demonstrates a relationship between task value and task choice. These results suggest that high task values are related to task choice and the differences between the two groups are statistically significant.

Correlations

		First On-line Class	English Class	English Grade	English as Second Language	Gender of Participant	Ethnic Background of Participant	Age of Participant	Drop Class	Class of Participant	UTILITY	INTEREST	IMPORT
First On-line Clas	Pearson Correlati	1.000	.044	-.185	-.006	.048	.077	.053	.015	-.079	-.189	-.116	-.103
	Sig. (2-tailed)	.	.740	.161	.966	.721	.561	.688	.911	.550	.151	.381	.437
	N	59	59	59	59	59	59	59	59	59	59	59	59
English Class	Pearson Correlati	.044	1.000	.171	-.104	-.091	.052	.114	.119	-.335*	-.295*	-.156	-.135
	Sig. (2-tailed)	.740	.	.196	.434	.495	.697	.391	.367	.010	.023	.239	.308
	N	59	59	59	59	59	59	59	59	59	59	59	59
English Grade	Pearson Correlati	-.185	.171	1.000	-.170	-.098	-.074	-.062	-.288*	-.154	-.032	-.203	-.292*
	Sig. (2-tailed)	.161	.196	.	.199	.459	.575	.642	.027	.245	.811	.124	.025
	N	59	59	59	59	59	59	59	59	59	59	59	59
English as Second Language	Pearson Correlati	-.006	-.104	-.170	1.000	.002	.201	-.069	.138	-.081	-.119	-.071	.115
	Sig. (2-tailed)	.966	.434	.199	.	.988	.127	.603	.299	.543	.371	.595	.387
	N	59	59	59	59	59	59	59	59	59	59	59	59
Gender of Particip	Pearson Correlati	.048	-.091	-.098	.002	1.000	.145	-.004	-.204	-.050	-.072	-.016	-.018
	Sig. (2-tailed)	.721	.495	.459	.988	.	.272	.974	.121	.706	.589	.906	.890
	N	59	59	59	59	59	59	59	59	59	59	59	59
Ethnic Background Participant	Pearson Correlati	.077	.052	-.074	.201	.145	1.000	-.040	.030	-.069	-.201	-.141	-.179
	Sig. (2-tailed)	.561	.697	.575	.127	.272	.	.766	.820	.604	.127	.287	.176
	N	59	59	59	59	59	59	59	59	59	59	59	59
Age of Participant	Pearson Correlati	.053	.114	-.062	-.069	-.004	-.040	1.000	.292*	.007	.159	.202	.265*
	Sig. (2-tailed)	.688	.391	.642	.603	.974	.766	.	.025	.959	.229	.124	.043
	N	59	59	59	59	59	59	59	59	59	59	59	59
Drop Class	Pearson Correlati	.015	.119	-.288*	.138	-.204	.030	.292*	1.000	-.022	.352*	.437*	.285*
	Sig. (2-tailed)	.911	.367	.027	.299	.121	.820	.025	.	.867	.006	.001	.029
	N	59	59	59	59	59	59	59	59	59	59	59	59
Class of Participar	Pearson Correlati	-.079	-.335*	-.154	-.081	-.050	-.069	.007	-.022	1.000	.205	.362*	.058
	Sig. (2-tailed)	.550	.010	.245	.543	.706	.604	.959	.867	.	.119	.005	.660
	N	59	59	59	59	59	59	59	59	59	59	59	59
UTILITY	Pearson Correlati	-.189	-.295*	-.032	-.119	-.072	-.201	.159	.352*	.205	1.000	.683*	.697*
	Sig. (2-tailed)	.151	.023	.811	.371	.589	.127	.229	.006	.119	.	.000	.000
	N	59	59	59	59	59	59	59	59	59	59	59	59
INTEREST	Pearson Correlati	-.116	-.156	-.203	-.071	-.016	-.141	.202	.437*	.362*	.683*	1.000	.610*
	Sig. (2-tailed)	.381	.239	.124	.595	.906	.287	.124	.001	.005	.000	.	.000
	N	59	59	59	59	59	59	59	59	59	59	59	59
IMPORT	Pearson Correlati	-.103	-.135	-.292*	.115	-.018	-.179	.265*	.285*	.058	.697*	.610*	1.000
	Sig. (2-tailed)	.437	.308	.025	.387	.890	.176	.043	.029	.660	.000	.000	.
	N	59	59	59	59	59	59	59	59	59	59	59	59

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 1. Correlation of All Variables including Task Value and Demographics

Rotated and component factor analysis were also conducted to confirm the item groupings of the scales and evaluate the variables. These analysis attempt to provide evidence of the independence of the variables. Essentially, the degree of differentiation among the items for each Task Value variable of the Task Value construct is examined. Most of the items are identified as coherent, and supporting the construct, but not independent. It may be significant that Eccles (1985) in some of her work used the three separate components as undifferentiated within the Task Value construct (Greene, DeBacker et al. 1999).

Implications

The results of the study demonstrate that Task Values are strongly correlated with Task Choice. Importance Interest and Utility, three components of Task Value, appear to be positively related to a student's decision to stay enrolled in a class. Consequently students who have high task choice values can be expected to persist in a class. This was shown in the strong relationship between these values and student behavior. In addition, the study showed that the demographics did not appear to be significant in differentiating student behavior, except for the findings that the older students and students with low prior English grades were not as likely to choose to stay in the class. Persistence in the class was not influenced by gender, ethnicity, subject (political science or psychology), or level of prior English classes or English as a second language. Therefore students with low task values, low prior grades in English, and older students may be more likely to drop out of a completely web-based class.

The findings of the study suggest that Task Value is an Indicator of Choice. This is consistent with earlier studies that looked at task values and behavior in other populations and environments. (Eccles, 1995; Greene, DeBacker, et al, 1999; Lin, 1999). In fact, the prediction made by Eccles and Wigfield (1995) that Utility would increase over Interest in studies with an older population of students, was found. Comparing the coefficients obtained by Eccles and Wigfield in their studies of adolescent math students with the results obtained for this population of adults, the values in this study were stronger. This was predicted by Eccles and Wigfield, 1995 and later By Greene, DeBacker, et al, 1999). Based on findings by Harter (1981), indicating academic achievement becomes more

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extrinsic with age, Eccles and Wigfield (1995) suggested that utility value would increase with age over interest value. In this study students from ages 18 – 52 found utility value stronger than interest value, although both were high.

The findings of the study suggest that most of the demographics measured are not indicative of student task values or task choice in the class, with two exceptions. The two demographic variables that were significant were prior grade in English and the age of the student. The variables of first online class, college English, high school English, English as a second language, gender, and ethnic background were not indicative of a student's task values or task choice. In other words, they did not indicate whether a student would drop or stay in the class. But there were significant correlations for English grade of -.288 and age of participant .292 were significant at the .05 level (2-tailed). This meant that students who'd done well in English classes were more likely to stay in the class and that the older students were more likely to drop the class.

There is also some evidence that dropping the class is negatively correlated with the grade achieved in English. This is a result that might be expected, where a student who has stronger English skills would find the text-based demands of a web-based distance learning class to make success in this academic environment easier. The finding that a high grade in a prior English class would indicate a student's choice to remain in a class seems to be a logical outcome in light of the nature of internet delivered web-based classes. They are highly text oriented. The majority of the difficulty in an online class is the demand for effective writing skills. Although reading and critical thinking are also required, the student is evaluated on how well they can express what they have learned in writing. They do not have the opportunity to verbally join class discussions. This high reliance on English skills may cause students whose English skills are weak to opt out of the class. Interestingly English level and ESL were not significant. So it suggests that students who do well in English prefer this type of class, regardless of what prior coursework they may have had in English, and in this regard may be self-screening.

There is also a result that dropping the class is correlated with age. It is not clear why older students, in this case those in the 28 – 50 range would be more likely to drop the class. Considering the large majority of students were women, it may be considered that work and family demands are more likely to interfere with this group of students. These were the reasons given most often as interfering with success of adult learners in other studies (Kember, 1990). From the limited sample size it would be hard to draw conclusions on these matters, but it suggests a need for further exploration. Questions about work and family demands might confirm these results.

These findings may represent anomalies because of sample size, but may also be measures of other motivational factors. Kember (1990) mentioned the same finding in his research involving adult distance learners. It may be that older, in this case students between the mean age of 30 and the oldest at 52, may have had more interruptions from work and family. Some other studies distance education studies did not find a significant effect of age. The relationship of age to drop out appears to be a finding that may be related to the size or composition of the sample, or confounded by other factors such as the marital status, number of children or work demands. Considering the students sampled live in silicon valley in the midst of a very pressured fast economy, it is not surprising that older students may have less expendable time and incorrectly assumed that the flexibility of online classes would allow them to take classes they otherwise would not be able to fit into their schedules.

Of particular importance to attempts to predict student performance is the finding that English levels, experience in online classes, ethnicity, and English as a second language, did not predict student choice. Task values were much stronger indicators of choice behavior. Also of significance is the finding that prior low grades in English may be important in indicating a student's decision to drop out of a web-based class.

In brief, students who have high task choice values can be expected to persist in a class. This was shown in the strong relationship between these values and student choice behavior. In addition, the study showed that most demographics measured did not appear to be significant in differentiating student behavior, with the exception of older students and those with poor prior grades in English being more likely to drop out. Gender, ethnicity, type of social science class, or level of English ability did not influence persistence in the class. These findings are also important in correctly identifying at risk students and in streamlining a possible instrument for this purpose

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PAWS: Personalized Adaptive Web Search

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Abstract

Information on the World Wide Web is abundant. However to accurately locate a piece of information a particular user wants at a particular time is a very challenging task. Researchers proposed various techniques and methods to improve the search accuracy. This paper presents project PAWS, Personalized Adaptive Web Search, our effort to ease the Web search task. In PAWS, user's search query is sent to a general purpose search engine of user's choice. The results returned by the search engine is filtered using user's profile. The similarity between the returned URL and the user profile is calculated and the URLs are ordered based on this similarity. After the filtered URLs are presented to the user, the user can interactively select what she wants from the list of URLs. The user can mark which URLs are preferable and which ones are not. PAWS then uses these feedbacks to learn the user's preferences and apply Tailered Winnow2 algorithm (TW2) to adjust rankings of the URLs. Once the URL rankings are adjusted, the results are sent back to the user. This interaction continues until the user finds satisfactory URLs.

Keywords: meta-search engine, World Wide Web, personalized Web search, adaptive-learning

1 INTRODUCTION

Information on the World Wide Web is abundant. According to a recent study (Lawrence & Giles 1999), there are estimated 800 million pages on the Web. It is not too surprising to see the number of pages today over one billion pages. Finding accurate information on the Web in a reasonable amount of time is very difficult. General purpose search engines such as Google[GG], AltaVista[AV], Yahoo![YH], NothernLight[NL] do help. But with exponential growth in the size of the Web, the coverage of the web by general search engines have been decreasing, with no engine indexing more than about 16% of the estimated size of the publicly indexable Web (Lawrence & Giles 1999). In response to this difficulty, three general approaches have been taken recently. One is the development of *meta-search engines* that forward user queries to multiple search engines at the same time in order to increase the coverage and hope to *include* in a short list of top-ranked results what the user want. Examples of such meta-search engine include MetaCrowler [MC], Inference Find [IF] and Dogpile[DP]. Another approach is the development of *topic-specific* search engines that are specialized in particular topics. These topics range from vacation guides [VS] to kids health [KH]. The third approach is to use some group or personal profiles to personalize the Web search. Examples of such effort include GroupLens (Konstan et.al. 1997) PHOAKS (Terveen et.al. 1997) among others. General search engines cover large amount of information even though the percentage of coverage is decreasing. But users have a hard time to locate efficiently what they want. First generation of meta-search engines addresses the problem of decreasing coverage by simultaneously querying multiple general purpose engines. These meta-search engines suffer to certain extent the inherited problem of *information overflow* that it is difficult for users to pin down specific information that they are searching for. Specialized search engines typically contain much more accurate and narrowly focused information. However it is not easy for a novice user to know where and which specialized engine to use. Most personalized search projects reported so far involve collecting users behavior at a centralized server or a proxy server. While it is effective for the purpose of e-commerce where venders can collectively learn consumer behavior, this approach does present the privacy problem.

Users of the search engines would have to submit their search habit to some type of servers, though most likely the information collected is anonymous.

This paper reports the project PAWS, Personalized Adaptive Web Search, our effort to ease the Web search task. In PAWS, user's search query is sent to a general purpose search engine of user's choice. The results returned by the search engine is filtered using user's profile. The similarity between the returned URL and the user profile is calculated and the URLs are ordered based on this similarity. After the filtered URLs are presented to the user, the user can interactively select what she wants from the list of URLs. The user can mark which URLs are preferable and which ones are not. PAWS then uses these feedbacks to learn the user's preferences and apply Tailered Winnow2 (TW2) algorithm (Chen & Meng 2000) to adjust rankings of the URLs. Once the URL rankings are adjusted, the results are sent back to the user. This interaction continues until the user finds satisfactory URLs. PAWS' personalization component is based on one of our projects (Meng & Chen 1999) and its interactive learning component is based on our Yarrow project (Chen & Meng 2000).

We present the architecture of PAWS in Section 2, some of the implementation details are also discussed. In Section 3 other related projects are reviewed, followed by some concluding remarks in Section 4.

2 ARCHITECTURE OF PAWS

The architecture of PAWS is shown in Figure 1. Its interface takes user query and the selected search engine as well as the number of returned pages as input. This input is parsed out by the Query/Feedback Parser. For the original query, the flow of control goes to the QueryConstructor which constructs the query for the selected search engine such as AltaVista or Yahoo!. The constructed query is then sent to the appropriate search engine by the Meta-Searcher. Currently PAWS supports a number of different general purpose search engines. It can be expanded to include more search engines since the program is highly modularized. When the results are sent back from the search engine(s) they are fed through DocumentParser, DocumentIndexer, Personalizer and Ranker to rank the documents. In DocumentParser and DocumentIndexer we collect all the keywords from the documents and index them by their frequencies. In Personalizer we calculate the similarity between the pre-collected user profile and the Web document retrieved. The Ranker simply sorts the URLs based on the similarity. At this point of time, the results are shown to the user. Only the top m most favorable and the bottom m least favorable URLs are displayed. Here m is a tunable parameter and usually is set to 10. The user then interacts with PAWS by specifying which of the top m and bottom m URLs are indeed relevant or not relevant (see Section 2.2 for interface description). This feedback is sent back to PAWS through the Query/Feedback Parser and the Dispatcher forwards this feedback to the TW2 component. The TW2 component implements the tailed Winnow2 algorithm (Chen & Meng 2000) that promotes the favorable URLs and demotes the un-favorable URLs that are judged by the user. The ranks of the URLs are recalculated and displayed to the user again. This feedback process can continue until the user finds the desired document.

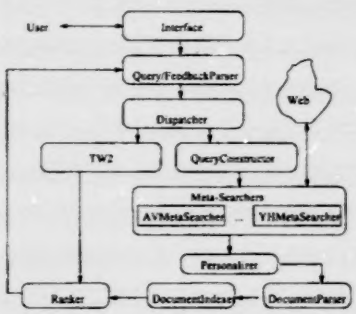

Figure 1: Architecture of PAWS

Many components of PAWS are based on our Yarrow project. We concentrate on the new component,

the Personalizer, here in this paper. Other components of PAWS are briefly described. Since these components are derived from our Yarrow project, please refer to (Meng & Chen 2001) and (Chen & Meng 2000) for detailed discussions of these components.

2.1 THE PERSONALIZER

The Personalizer is a key part of PAWS. People leave "digital traces" on the computers they use, especially on the computers dedicated to a single person. These traces include, among other things, email messages, digital news, work related documents, personal documents and others. All these traces are distinct from one person to another because of the natures of their work, their personalities and other characteristics. When a person does a search on the Web, the information interesting to that person is ultimately related to the "digital trace" left on her computer. If we use these digital traces to filter the search results returned from search engines before presented to the user, one would expect the results be much more accurate. The user can collect her own profile on the client. This collecting process is done periodically, but not every time when the user wants to search something. This collection of profile can be a part of the client software (browser) functionality. Also possible is to have a separate program perform this task. The key issues here are that the collecting process is initiated by individual users; the user knows exactly what is collected; and the results are not available to any one else, including search engines.

In this work, we simply use the words that appeared in user's documents as the base of the profile. The profile consists of a number of most frequently used words in user's document collection. The collecting process simply traverses the directory tree of the user's computer, examines every document on its way. When a text file, or a Word document is found, words are collected from these documents. The result is sorted according to the appearance frequencies of these words. The top n words are kept as the profile.

When a URL is retrieved from a search engine along with its brief summary, a similarity measure is computed between the profile and the URL. The similarity between the returned URL and the user profile is calculated using the popular *similarity* measure (Salton 1989). The similarity is based on the following idea. A returned URL U along with its short summary contains a set of words. We say U is similar to user's profile P which also contains a set of words. Both U and P can be represented as an m-dimensional vector $< w_1, w_2, ...w_m$ where term w_i represents the significance of the i^{th} word in the vocabulary. One common way to compute the significance is to multiply the number of times the i^{th} word appears in the document by the inverse document frequency (*idf*) of the i^{th} word. The *idf* factor is one divided by the number of times the word appears in the *entire* document collection. In practice, however, it is not possible to collect the *entire* document set. What we did here is to use the user's *home station* as the entire document collection. Thus the similarity between U and P is calculated as the inner product of the U and P vectors. This is a very rough approximation. But it is one measure that we could use. The accuracy of the measure is currently being studied.

Thus similarity S between URL U and profile P is calculated by the following formula.

$$S = \sum_{i=1}^{n} \frac{w_i(U)}{w_i(P)}$$

where n is the number of different words collected in P, $w_i(U)$ is the number of times the i-th word appeared in the URL and its summary, $w_i(P)$ is the number of times the i-th word appeared in the profile.

2.2 THE USER INTERFACE

PAWS user interface is shown in Figure 2. The user would have to enter the search keywords at the the `Search words` input box. The `Number of URLs` input box is provided with the default value of 40 which means by default PAWS will retrieve 40 URLs from the specified search engine. The user may specify any positive numbers they want to. The larger the number is, the more time would have to be spent in retrieving URLs when building the index and the rank. The user also has the option of specifying which search engines to query from the list of eight search engines. By default PAWS uses AltaVista. Once these parameters are specified (at the minimum the user has to provide the search keyword), the user can click the `Search` button and the search process begins.

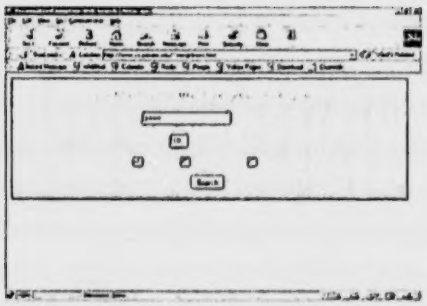

Figure 2: Interface of PAWS

After PAWS contacts the specified search engine, the results returned from the search engine are personalized and displayed, as shown in Figure 3

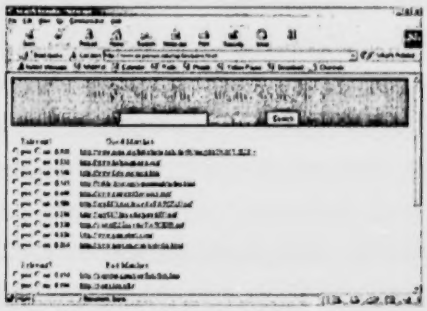

Figure 3: Personalized Query Result for the Keyword "paws"

At this point, the user may click on a sequence of `radio buttons` that indicate whether or not a given URL is relevant. The user may choose not to click on any button (no feedback) or she may click as many as needed. If the user is not sure about a particular URL, she can actually click on the live URL and view the actual page before making a decision. When the user finishes the selection, she clicks the `feedback` button (at lower-left corner in Figure 3). The refinement process is then underway. PAWS re-calculates the rank based on the feedback using the TW2 algorithm. The refined results are then displayed for the user (see Figure 4). The user has the opportunity to review the URLs and send feedback to PAWS again. This adaptive process continues until the user finds satisfactory results.

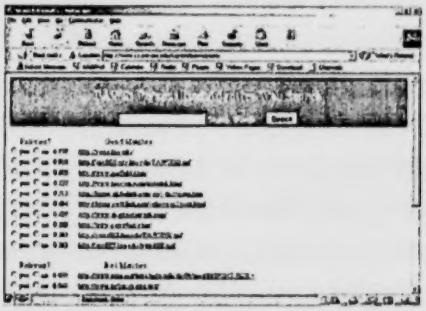

Figure 4: Refined Result for "paws" after 1 Iteration and 5 Examples

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2.3 THE OTHER COMPONENTS OF PAWS

Most other components of PAWS are derived from our Yarrow project. These components include the QueryConstructor, the Meta-Searchers, the DocumentParser and the DocumentIndexer, as well as Ranker and the Learner (TW2). Please refer to (Chen & Meng 2000, Meng & Chen 2001) for details. We briefly describe them here.

The QueryConstructor is responsible for building appropriate query string for the search engine that is specified by the user. The query is sent to the Meta-Searchers. The Meta-Searcher contacts the general search engine of user's choice. In the prototype we support three general search engines, AltaVista, NorthernLight, and Yahoo!. Support for other search engines can be implemented in a similar manner. The Meta-Searcher receives the search results returned by the search engine and "cleans" up these results to make them as a sequence of URLs and their summaries. The cleaned-up URLs along with their comments are then sent to DocumentParser and DocumentIndexer. DocumentParser parses the list of URL and their summaries into a sequence of keywords. The DocumentIndexer indexes them into a list of keywords. The keyword-vector representations for all the received documents are constructed. The Ranker ranks the URLs according to the information. When the URLs are ranked, they are displayed to the user. The user then can send feedback to PAWS by clicking which URLs are relevant and which ones are not. PAWS then employs the Learner which implements the TW2 algorithm to re-rank the URLs according to user's feedback. The results are sent to the display. The user can interact with PAWS in this manner until she is satisfied with the results.

3 RELATED WORKS

PAWS concentrates on personalization using user profile. There are many other research projects that deal with the similar issue. In this section we review some of the related works. PHOAKS (Terveen et.al. 1997) (People Helping One Another Know Stuff) is a collaborative filtering system that recognizes and reuses recommendations. PHOAKS recommends relevant, high-quality ifnormation on the Web to users by automatically recognizing, tallying and redistribution recommendations of Web resources mined from Usenet news messages. It is based on group profiles. Recommender (Basu et.al. 1998) recommends movie to a user using social and content information. The social information comes from the preferences of viewers of a particular movie such as user rating. The content information comes from the descriptions about the movie such as director, actors and actresses, category of the movie, composers and others. The system uses a hybrid of information both from social and content categories to predict users' preferences about a movie. Ringo (Shardanand & Maes 1995) is a personalized music recommendation system. This is an example of a general approach to personalized information filtering using *social information filtering*. Siteseer (Rucker & Polanco 1997) is a personalized navigation tool for the Web. It is a Web-page recommendation system that uses an individual's bookmarks and the organization of bookmarks within folders for predicting and recommending relevant pages. GroupLens (Konstan et.al. 1997, Resnick et.al. 1994) is a collaborative filtering system for Usenet news. The GroupLens server has a two-part database. The *ratings* database stores all ratings that users have given to messages. The *correlations* database stores information about the historical agreement of pairs of users. Using these two set of data GroupLens predicts what a particular user mignt like to read. Fab (Balabanovic & Shoham 1997) is an implementation of hybrid approach to combine collaborative and content-based filtering systems. In *content-based* recommendation one tries to recommend items similar to those a given user has liked in the past, whereas in *collaborative* recommendation one identifes users whose tastes are similar to those of the given user and recommends items *they* have liked.

4 CONCLUDING REMARKS

This paper describes our project, PAWS, Personalized Adaptive Web Search. PAWS uses personalized information on the client side to aid Web search. PAWS also utilizes efficient learning algorithm TW2 to interactively refine the search process. Users can send feedback to PAWS to narrow the search results until she is satisfied. Unlike many popular collaborative search mechanism, PAWS keeps the user profile on the

client side so the privacy of the user information is protected. PAWS' advanced interactive learning algorithm makes the search effective and efficient. Currently we are working on the evaluation of the system.

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URLs Used in the Paper

[MC] MetaCrawler <http://www.metacrawler.com>
[IF] Inference Find: <http://www.infind.com>
[DP] Dogpile <http://www.dogpile.com>
[VS] VacationSpot.com <http://www.vacationspot.com>
[KH] KidsHealth <http://www.kidshealth.com>
[AV] AltaVista <http://www.altavista.com>
[NL] NorthernLight <http://www.northernlight.com>
[YH] Yahoo! <http://www.yahoo.com>
[GG] Google <http://www.google.com>

Preserving and Protecting the Freedom to Learn Online

William Merrill, Central Michigan University, USA

With the passage of the Children's Internet Protection Act in Decem-ber 2000, the federal government attempted to legislate a "feel good, quick fix" for protecting children from "harmful materials" on the Internet. The legislation requires public schools and libraries to install filters on all their computers or loose the government's e-rate for Internet access. Not only do filters have technical problems, the act of filtering blocks information adults can legally access and blocks many sites incorrectly that are appropriate for young people. This paper is a discussion of the issues surrounding filtering and realistic alternatives that do not trample the First Amendment.

Project LEARN: Encouraging students to pursue careers in the mental health sciences through web-based technology

Yanko Michea, Health Science Center at Houston, USA; Irmgard Willcockson, Health Science Center at Houston, USA; Cynthia Phelps, Health Science Center at Houston, USA

LEARN (Learning Education And Research Network) is designed to take advantage of the internet and associated web-based technologies to reach it's main goal of encouraging students to pursue careers in the mental health sciences. We are creating a multifaceted curriculum that integrates methodologies shown to be effective in modifying career choice; including, developing hands-on science activities, providing role models, giving career facts and information, and teaching mental health science content. Each of these methodologies is disseminated via the web, and web-based technology provides added value to the learning process engaging the students in the material. Technology plays a central role in our development. The decision about how and when to use technologies is related to the characteristics of the content and the pedagogical objectives. We believe that the use of technology must act to support the content and also facilitate the process. Generally, we use multimedia technology to offer a learning environment otherwise inaccessible because of special constraints, like technical difficulties, costs or physical constraints. We also use technology to provide context for the information making the content more relevant to students' lives or when technology offers a motivational advantage. We are designing a curriculum that takes advantage of social interaction, gaming and constructivism to achieve our goal. We believe that teamwork is one of our strongest weapons, and that technology is an extremely powerful ally. LEARN is funded by grant R25 MH61917 from The National Institute for Mental Health.

Sexual Harassment Online Training

Robert Miller, Eastern Illinois University, USA

In order to provide a better working and learning environment, and to comply with state and federal law, Eastern Illinois University requires new employees to complete a sexual harassment training session within their first six months of employment. Because of scheduling conflicts or demands, this seminar is now being offered online. There are many challenges in developing this type of online course and special care must be taken to create the most interactive, informative, and user-friendly version possible. An effective course design will encourage and facilitate active user participation and will incorporate animation, audio, and other multimedia elements that enrich the learning process.

Learning Technology Standards for E-Learning

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Abstract: Learning technology standards provide a uniform, stable elearning environment. In this role, they serve the same purpose as standards in other industries such as construction, publishing, and television broadcasting. Learning technology standards allow elearning content providers to focus on creating effective training using technology rather than focusing on the technology itself. During this paper, we will define the term "standard," and list reasons why standards are important to collaborative activities like elearning. We will then review the major learning technology standards initiatives underway in the United States, and identify commonalities and differences among these standards efforts.

Introduction

Learning technology standards provide a uniform, stable elearning marketplace. In this role, they serve the same purpose as standards in other industries such as construction, publishing, and television broadcasting. Learning technology standards allow elearning content providers to focus on creating effective training using technology rather than focusing on the technology itself.

During this paper, we will define the term "standard," and list reasons why standards are important to collaborative activities like elearning. We will then review the major learning technology standards initiatives underway in the United States, and identify commonalities and differences among these standards efforts.

What is a Standard?

A standard is an established norm for a given activity or product. Examples of standards include weights and measures, construction specifications, and television broadcasting formats. A standard establishes what is normal for a given product or process. Moreover, standards are usually used widely and generally regarded as authoritative. Standards sometimes have the force of law (Building codes for example), but in many cases are simply the accepted ways of constructing or producing something.

Importance of Learning Technology Standards

Currently, most elearning is developed outside of any type of universal standard. Because of this, elearning designers often have to rebuild their lessons every time the lessons are moved to a new website or learning management system. The result is that a lot of time, money, and resources are wasted reworking elearning to get it to work on different host environments. Money and time spent rebuilding an elearning piece simply to move it from LMS A to LMS B means that those resources are not available to construct new elearning programs.

To see why this is a problem for elearning, consider this scenario. Imagine every time you moved a book from one bookshelf to another, you had to completely rebuild the book. Just to move the book across your office required redesigning the structure of the chapters, re-typesetting the entire book after restructuring, reprinting the book, and having it rebound. If this were the case, you wouldn't move your books very often or loan them

to colleagues. This limitation would hamper your ability to use the book and gain benefit from the information contained within it.

As you can see, the lack of uniform standards prevents the widespread success of elearning. Just as uniform publishing technology standards (movable type) facilitated the widespread production and use of books, the true potential and power of elearning is realized through standards.

Commonalities Among Standards

In general, all learning standards attempt to standardize:

- Data interchange between elearning courses and learning management systems
- Meta-data interchange between elearning courses and learning management systems
- Student data analysis of the student scores on elearning assessments

In addition, some standards attempt to:

- Standardize course structure
- Allow for learning content reusability

The Standards

The major learning standards currently in use or development are:

- AICC
- SCORM
- IMS
- IEEE

AICC

AICC stands for Aviation Industry CBT Committee. Founded in 1988, the AICC is the oldest elearning standards body. A consortium of airplane manufacturers and airlines formed AICC. The AICC standard is used for data exchange between courseware and LMS systems. Its goal is to promote interoperability between courseware and LMS systems from different vendors. It does not prescribe any type of instructional methodology or content reusability strategies. It is content neutral, and simply attempts to promote communication between courseware and LMS systems developed by diverse vendors. It accomplishes this by defining a set of data fields that are used to pass information back and forth between courseware and LMS systems. The data field format and the communication protocol are specified by the standard. AICC compliant courseware and LMS systems use the data fields and communications protocols in the manner specified by the standard to achieve interoperability. AICC compliant courseware and LMS systems can be file-system or web based.

SCORM

SCORM stands for Shared Content Object Reference Model. ADL, founded in November 1997 by the Department of Defense (DoD) and the White House Office of Science and Technology Policy (OSTP), developed SCORM. ADL stands for the Advanced Distributed Learning initiative. The SCORM standard specifies a courseware development model that facilitates interoperability and reusability. Like AICC, SCORM specifies a set of data fields and a communication protocol to pass information back and forth between courseware and LMS systems. Unlike AICC, however, SCORM specifies a structure for building courseware. In the SCORM structure, there are three types of content: Assets, Shared Content Objects (SCOs), and Blocks. Assets are individual pieces of content. JPEGs, Text, and Flash animations are all examples of SCORM assets. Shared Content Objects are small groupings of assets that form a single piece of content. SCOs are objective and context neutral. For example, a picture of a diesel engine and some text describing a diesel engine are assets, and can be grouped together to form an SCO. The grouping, however, must be completely devoid of any learner/course specific context and course objectives to be a valid SCO. Blocks are groupings of SCOs. A Course Structure File provides learner context, objectives, and course structure in SCORM. The Course

Structure File or CSF sequences all of the SCOs and blocks, and seamlessly integrates them with course context and objectives contained in the CSF file.

IMS

IMS stands for Instructional Management Systems (IMS) Project. IMS is a consortium of government organizations, over 1,600 colleges and universities, and 150 corporations. The IMS standard is actually a group of standards that attempt to create a uniform way to describe learning resources, share data about learners, courses, and performance, make it easier to create reusable content objects, share test items and other assessment tools across different systems, and organize learner information. Primarily, the IMS standards accomplish these tasks through specifying meta-data fields in each area and a protocol for the exchange of this meta-data between courseware and LMS systems. The one exception is the Question and Test Interoperability standard which specifies a uniform way for creating, presenting, judging, providing feedback for, reporting results from, and tracking question-based interaction and assessment items.

IEEE

IEEE stands for The Institute of Electrical and Electronics Engineers. The IEEE sets standards for everything that uses electricity in the United States. Many of the IEEE standards are adopted by the National Standards Institute (An agency of the Federal government) and by the ISO (International Standards Organization). The IEEE Learning Technology Standards Committee, or LTSC is working to create a comprehensive set of standards for every aspect of elearning. This standard, titled IEEE 1484, will be presented to the ISO for adoption when complete. Currently, this standard is still in development. Areas covered by IEEE 1484 include a comprehensive learning technology architecture and reference model, learner data models, student identifier systems, a universal competency definition model, a universal CBT interchange language, a course sequencing standard, content packaging standards, a learning objects metadata standard, localization standards, semantics and exchange bindings standards, data interchange protocols, management systems and applications standards, computer managed instruction standards, platform and media profiles data interchange standards, and tool/agent communication standards.

Review

Learning standards provide uniformity in the elearning marketplace, and allow content providers to focus on content. A standard is the accepted norm for an industry, and is widely used and respected in that industry. Standards sometimes have the force of law (Building codes for example), but in many cases are simply the accepted ways of constructing or producing something.

In general, all learning standards attempt to standardize: Data interchange, meta-data exchange, and student data analysis. In addition, some standards attempt to standardize course structure and allow for learning content reusability. The major standards in use or under development in the United States are AICC, SCORM, IMS, and IEEE.

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The Collaborative Learning Support in the INTERNET Learning Space

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Abstract: The purpose of this study is to support the learning activity in the Internet learning space. In this paper, we examine the knowledge management and the knowledge representation of the learning information for the collaborative learning support. RAPSODY-EX is a remote learning support environment organized as a learning infrastructure. This can effectively carry out the collaborative learning support in (a)synchronous learning mode. Remote learning is a learning style where individual learning and collaborative learning are carried out on the multimedia communication network. To enhance the Internet as a learning environment, the educational knowledge management mechanism and a collaborative design and planning tool are proposed.

Introduction

The development of the recent information communication technology is remarkable. As an effect of this, the education environment is being modified to a new environment which differs qualitatively from the previous one[Davenport 1997]. The new education environment contains not only computer but also communication infrastructures such as the information communication network represented by the Internet[Cumming 1998, Elliott 1993]. We call this learning environment the Internet learning space. Information is transmitted for the learner in this learning space from the external space. The information quantity that is available to the learner is enormous. However, there is a limit to the information quantity which the learner can process. The imbalance of this information processing quantity is a peculiar phenomenon in post modern ages. Secondary phenomena are also triggered by this problem. These phenomena become factors which inhibit the sound transmission of knowledge and the progress of learning[Mcneil 1998, Chan 1997]. In asynchronous learning, the transformer of knowledge and the transformee of knowledge communicate with a time lag. In such a situation, more positive support is required to realize an effective and efficient learning activity. We need to build a learning infrastructure with learning spaces with various functions.

The purpose of this study

We investigate the mechanism of transmission and management of knowledge for the development of the knowledge community in the learning space, within the educational context. In this paper, we examine the knowledge management and the knowledge representation of the learning information for the collaborative learning support. The purpose of this study is to support the learning activity in the Internet learning space. RAPSODY-EX (Remote and Adaptive Educational Environment : A Dynamic Communicative System for Collaborative Learning) is a remote learning support environment organized as a learning infrastructure[Okamoto 2000]. RAPSODY-EX can effectively carry out collaborative learning support in asynchronous/ synchronous learning mode. Remote learning is a learning style where individual learning and collaborative learning are carried out on the multimedia communication network. Remote education/learning support systems are classified into 2 types. One type is a system using the advanced information network infrastructure to realize smooth communication for remote education/learning. The other type represents systems which positively support various activities of remote education/learning. RAPSODY-EX has both functions. In the remote learning environment, arrangement and integration of the learning information are attempted to support the decision making of learners and mediators. Various information in the educational context is referred and reused as knowledge which oneself and others can practically utilize. We aim at the construction of an increasingly growing digital portfolio database. In addition, the architecture of the learning environment including such a database is researched.

Collaborative Learning with RAPSODY-EX

A learner group which guarantes the smooth transmission of knowledge can form a community (the knowledge community) by sharing and reusing common knowledge. Learning activities which occur within this group are as follows : the achievement of learning objectives as a group; the achievement of the learning objectives of each learner; the achievement of the learning objectives of the learner group which consists of multiple learners. RAPSODY-EX supports the transmission of knowledge in the learner group and the promotion of the learning activity. It is indispensable that RAPSODY-EX has the following functions :

1) the function which controls learning information for the individual learner and the group.
2) the function which manages learning information of the learner for mediation.

The learner and group information are produced from the learning space. This information will be stored in the collaborative memory. This information is defined as learning information. We also define the method of information management of such information and the structure of the collaborative memory.

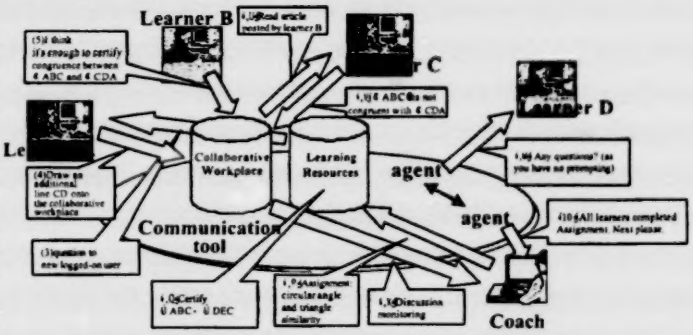

Figure 1 : Collaborative learning with RAPSODY-EX

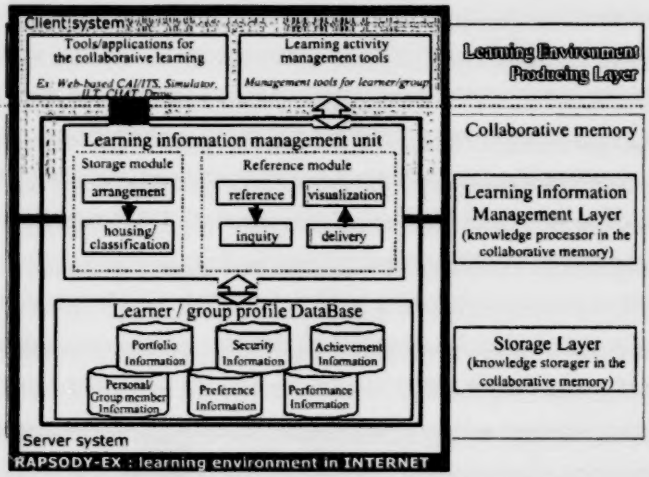

Figure 2: The mechanism schema of RAPSODY-EX

The management of learning information

The simple mechanism of the management of learning information developed in this study is shown in Figure 2. The processing mechanism consists of two components. The first one is a module which offers the learning environment. The second one is a collaborative memory which controls various information and data produced from the learning environment. In the learning environment, 2 types of functions are offered. One is the monitoring function for the learning progress. The other is the tool/application for the collaborative learning. The former function controls the learning history/record of individual learners and the progress of the collaborative group learning. The latter tool/application becomes a space/workplace for collaborative synchronous /asynchronous learning. The learning information which emerged from such a learning environment is handed to the collaborative memory. The collaborative memory offers 2 types of functions. One is the knowledge processing function, and the other is the knowledge storage function. In the former, input learning information is shaped to the defined form. In the latter, for the formatted information, some attributes related to content are added. The complex information processing takes place in the collaborative memory.

The knowledge management in RAPSODY-EX

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In this study, the processing described in the previous section is considered as a process of the knowledge management in the learning context. Knowledge management is defined like follows[Davenport 1997]. The knowledge management is "*the systematic process of finding, selecting, organizing, distilling and presenting information in a way that improves an employee's comprehension in a specific area of interest.*" Nonaka[1995] proposed the process of knowledge management as a SECI model. Figure 3 shows the SECI model. The SECI model is expressed as a conversion cycle between tacit knowledge and expressive knowledge. Tacit knowledge has a non-linguistic representation form. Expressive knowledge is a result of putting tacit knowledge into linguistic form. Tacit knowledge is shared with others by converting it into expressive knowledge. In the SECI model, socialization (S) / externalization (E) / combination (C) / internalization (I) of knowledge is expressed.

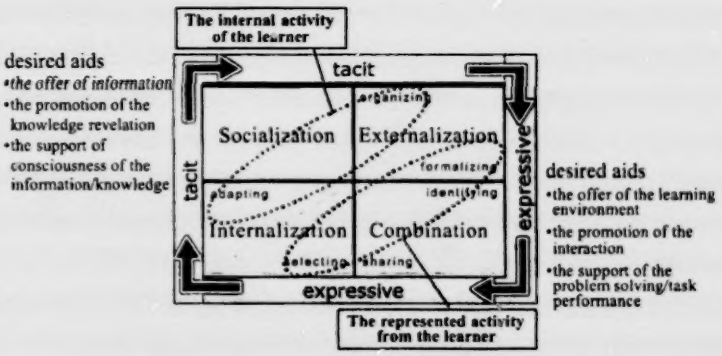

Figure 3 : The SECI model in the educational context

The knowledge management in educational context is defined as follows : "*the systematic process of finding, selecting, organizing, distilling and presenting information in a way that improves a learner's comprehension and/or ability to fulfill his/her current learning objectives.*" In RAPSODY-EX, the C(combination of knowledge) phase is supported. RAPSODY-EX also promotes the knowledge conversion to the I (internalization of knowledge) phase from the C phase and the knowledge conversion to the C phase from the E (externalization of knowledge) phase. The learning information contains the expressive knowledge of the learner. This expressive knowledge is a result of expressing tacit knowledge of the learner using the language. This knowledge is converted from the learner's tacit knowledge.

In this situation, what we have to consider is as follows :

- What are the knowledge resources in the learning group ?
- What is the gain for the learning group ?
- How are the knowledge resources controlled to guarantee the maximum gain for the learning group?

The collaborative memory

In the collaborative memory, information generation / arrangement / housing / reference / visualization are the management processes of expressive knowledge in the learning space. RAPSODY-EX is a learning environment which possesses a knowledge management mechanism. In this environment, 1) the review of the learning process, 2) the summarization of the problem solving process and 3) the reference of other learners' problem solving method are realized in the learning space. Learning information is expressed by an unified format. Then, that information is accumulated in the collaborative memory. This information becomes the reference object of the learner. The generation and the management of the information on the learning performance and the portfolio of the learner and group are main objects of the knowledge management. In this study, learning information is obtained from the application tools for the collaborative learning. It is necessary to control the learning record, the reference log of the others' learning information and the log of problem solving and learning progress. To realize this control not only techniques based on symbolic knowledge processing approach, but also techniques based on sub-symbolic knowledge processing approach are used.

The collaborative memory consists of two parts. One is the information storage unit. The other one is the management unit of the stored information. The information storage unit mainly processes 4 kinds of information.

1) Learning information,
2) Information on the learner,
3) Information on the setting of the learning environment and
4) Information on the learning result.

The information management unit deals with the reference / arrangement / integration of learning information. The Individual learner profile information is composed of information following the IEEE Profile information

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guidelines[IEEE 2000]. The group information is expressed by the expansion of the individual learner profile information. The conversion from the learning log data to learning information is necessary to develop this profile database. The information which should apply in learning information is as follows :

- Information and/or data on its learning context and/or learning situation
- information about the sender and the sendee of the information
- significance and/or outline in the educational context
- Information on the relation structure of the learning information
- the reference pointer to individual learner and group who proposed or produced the information
- the relation with other material

By adding these information, the learning information is arranged into an unique form. If a learner requires some information related to his/her current learning, RAPSODY-EX shows the (estimated) desired information to the learner.

Designing and Planning Support System for Collaborative Learning

In this study, the shared tool for supporting design and plan of learning activity in collaborative learning activity is proposed. We call this tool PRING. In PRING, the functions which mentioned above is implemented. PRING functions on RAPSODY-EX which is remote (internet based) asynchronous/synchronous collaborative learning support environment. In the following, the learning activity plan which is consisted in three types of processes and the storage and reference functions of PRING are described.

The executive process of the learning activity

We call the process for the learning activity the executive process (EP). In the EP, beginning of the group learning is defined as "START", and a goal of the group learning is defined as "GOAL". The group is expected to fulfill the GOAL in company with the group members collaboratively. The learners sets successively "the sub task for achieving the group goal" on the way of the process of the learning activity. These sub tasks are defined as "subGOAL". The series of subGOAL is correspondent to an EP. The conceptual scheme of a series of subGOAL in an EP is shown in figure 4. This scheme has a hierarchical structure. This hierarchical model is composed of "the learning item", "the learning content", "content of the learning content" and "learning method and technology" from the lower layer.

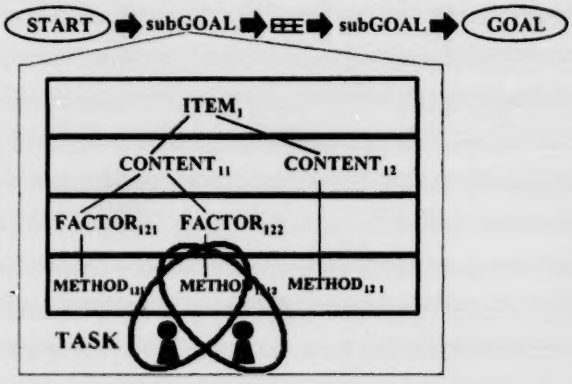

Figure 4 : The concept of the executive process

In PRING, the collaborative learning by the group begins from the designing and planning of the EP. In order to restrain the disadvantage of the group learning, it is necessary to allocate the subtask to all group member. The work based on METHOD is given to each learner. This work is defined a TASK. In the beginning of the group learning, the design of EP completely (from START to Goal) is not required. While the result of the previous TASKs are considered, the EP is sequentially designed. By repeating this process, the group achieves a GOAL.

When designs and plans EP, the idea as an individual and the idea as a group are both important. A learner is able to think these two type of ideas at a time. The learning processes are divided into two phases. One phase is a divergence and the other phase is a convergence. When a learner makes his/her idea for planing and/or designing the learning process, the idea also divided into two types, a divergence type and a convergence type. The divergence is the intuitive thought which does not stick common sense and evaluation. The effect spread for the richer image is expected. The convergence is the coordinative thought which consider the actuality.

The collaborative learning environment with PRING

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The architecture of the designing and planning system of EP with PRING is shown in figure 5. This is implemented as a client server system. PRING functions as an interface of the client system. The server system is called SPRING (Server of PRING). The client system is consisted by two modules. One is the drawing information analysis module. The other is the attribute addition module. This module adds the transmitter information, using tool information and operation timing information to user's operation data. In the server side, seven modules and two databases are implemented.

<module>

- the using tool analysis module
- the transmitter information analysis module
- the module for encoding for referring
- the module for decoding for referring
- the module for encoding for storage
- the activity history database management
- the group information database management

<database>

- the activity history database
- the group information database.

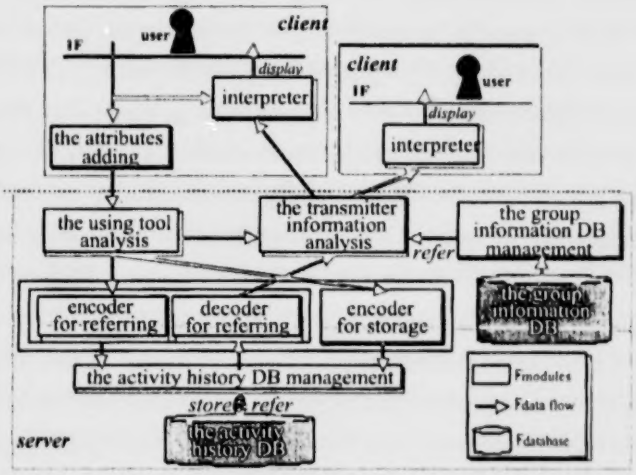

Figure 5 : The system architecture of PRING

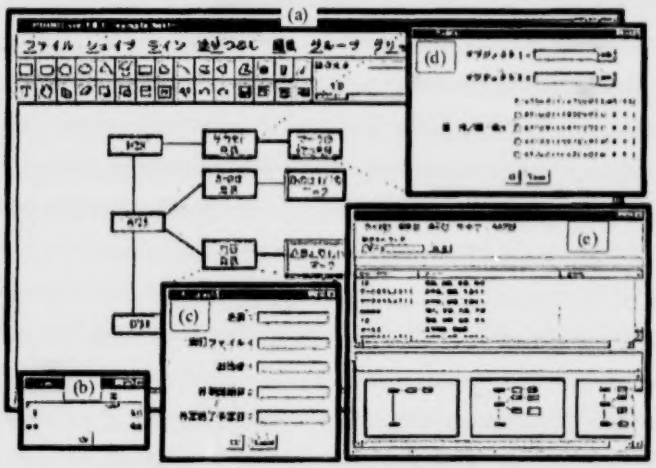

Figure 6 : Interfaces of PRING

The most purpose of the previous proposed systems is to give an appropriate support for the problem solving. In this case, a support object is specialized to some learning activity. In case of PRING, the support object is not specialized in the specific problem or activity. The purpose of PRING is to recognize the existence of a knowledge and to promote the problem solving. The learner cooperatively designs and plans the EP by using PRING. The functions which are implemented in PRING are as follows:(1) CAMPUS : By using this, user can also design and plan the EP. (2) STORE : a storage function the process of the collaborative learning in the group to the activity history database. (3) SEARCH : a reference function the activity history of the other group which performed the similar problem solving. (4) PLAYBACK : a reference function the activity history of the group which the user belongs to.

Example of use of PRING is shown in the figure 6. Firstly, CAMPUS(By using this, user can also design and plan the EP. The work flow function manages the designed and/or planned EP) is displayed, when PRING is started(a). A degree of divergence/ convergence(DDC) is defined by the group before designs and plans the EP(b). When design and plan the EP is finished, the defined DDC is improved based on the designed and planned EP. It is possible to respectively give the semantic attributions to any button and line on CAMPUS(C)(d). When the performance of designing and planning the EP is at deadlock, user use SEARCH function to refers the activity history of the other group which worked similar problem solving(e). The EP can change in factors such as result of learning, learning speed, capacity, or discovery for a new knowledge of the group/learner. According to these changes, the group reconsiders previous EP, and the new EP designs and plans. It is possible to give the opportunity in which the learner recognizes the difference of the EP of others' and/or another groups' by storing the process for design and plan of this EP. Furthermore, reference and reuse of the previous EP at self belonging group are also possible. The learner recognize the existence of a knowledge which dose not know by these functions, and the problem solving promotion is expected.

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Conclusion

The purpose of this study is to support the learning activity in the Internet learning space. We examine the knowledge management and the knowledge representation of the learning information for the collaborative learning support. RAPSODY-EX is a remote learning support environment organized as a learning infrastructure.
In this paper, the management of learning information in RAPSODY-EX is described. RAPSODY-EX is an integrated learning environment with a remote education infrastructure and supporting tools/applications for the collaborative learning. Also, in this paper, learning technology for the learning support is proposed. The knowledge management mechanism in the educational context is showed. The detailed knowledge management technique will be realized in the future, and it will be integrated with the current learning support environment.
In this study, the shared tool for supporting design and plan of learning activity in collaborative learning activity, PRING is also proposed. PRING functions on RAPSODY-EX. The concept for EP designing/planning and the collaborative function for support collaborative activity is shown

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Utlizing Computer Dictation for Language SampleTranscript

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The present project was designed to evaluate the effectiveness of using a computer dictation program, Dragon Naturally Speaking (DNS), to expedite the language sample transcription procedure. DNS is a voice recognition program that transcribes verbal output into written text. The feasibility of using DNS in the clinical environment would depend on two factors; 1) accuracy of transcript, and 2) feasibility of obtaining samples with minimal configuration to the computer. A language sample was first transcribed by the traditional process of listening to audio samples and entered into the computer. The same language sample was transcribed via the use of Dragon Dictate. Data were analyzed for accuracy of the transcribed language samples and the difference of data entry rates via the traditional approach versus Dragon Dictate. Data for the amount of training time for the dictation program was collected and analyzed in respect to accuracy rates.

Virtual Communities: a New E-learning Application for a Telecommunication Company

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Abstract — **Online Distance Learning System from CRT Brasil Telecom(Brazilian Telephone Company), has showed that technology and education found a commum point to perform good educational methodologies. Contents and ODL(Online Distance Learning) programs reached a very good point of performance and moreover, internal culture is much more prepared to use Online Learning than ever. The next target now is: how to orient employees to get good results on a "sea" of knowledge. CRT Brasil Telecom Knowledge Communities are assembled to give, trough the web, a natural orientation specifically prepared for professional and applied educational needs.**

I. Introduction

CRT, a recently privatized Telecommunication Company in Brazil, is now very well positioned at the global cenary of the competitive Corporations. Considering the increasingly need for education methodologies, CRT has developed a Distance Learning Strategy to prepare the Company for the future. Starting with the launch of a Distance Education and the establishment of a development team, now CRT has a full ODL (online distance learning) structure running over Intranet. So, what is the next corporate challenge for education ?

II. Objectives

The CRT Online Distance Learning structure, called SEND, was created to contribute on the search for an educational model for a Telecommunication Company, specifically adapted to internal culture aspects. This search started in December 1999 and already opened a full set of new possibilities of employees development. These opportunities could not be planned considering traditional paradigms of education. It was needed to embody aspects like continuing education and non presential training for the ODL development team and changes on internal culture for CRT employees.

In short, CRT is an year old Company WHICH trained over Intranet on a model that seems like to be definitive in terms of improvements on distance learning events, trough the web. These events reflect specific needs for technical, commercial (business) and administrative areas of CRT. That is why programs were created with different approaches in order to adequate the training to the employee.

For sure though, this is not enough. Survival for CRT now means to reach telecommunication goals that will make possible to start competition on different areas of Brazil. The key for this objective is the strengthening of the knowledge community with an oriented educational plan.

III. Constraints

Knowledge communities are composed by groups of professionals that share the same information and act on similar areas. As an example, it is pointed the Consultant Team which takes care of CRT business costumers. This group handles a lot of different technologies regarding telecommunication systems and also have to be well developed on communication, interpersonal and sales skills.

As a multidisciplinar group, training for this community is far away from exposing a deep set of distance learning contents and waiting for the conclusion of all events. As an example showing them a big library without orientation, employees usually do not have the aptitude to conduct their own development.

So, the CRT Distance Learning System, as being the system responsible for their education and development, has the mission of connecting suitable contents to specific knowledge communities, trough the web and all the tools the employees have to access in order to increase their knowledge.

IV. Implementation

A. Integrating Knowledge Communities

Some aspects must be considered in order to create and integrate a Knowledge Community. CRT Human Resources Training and Development area have developed human resource instruments like *education tracking* and *expert*

identification. This information composes data bases where it is possible to identify similar skills on education and job areas.

Training Consultants contribute with analysis of development needs, strategic plans and targets of each business department. With these information, it is possible to define communities with their respective plan of development and the nature of information needed to support a good job performance and communication flow for the teams.

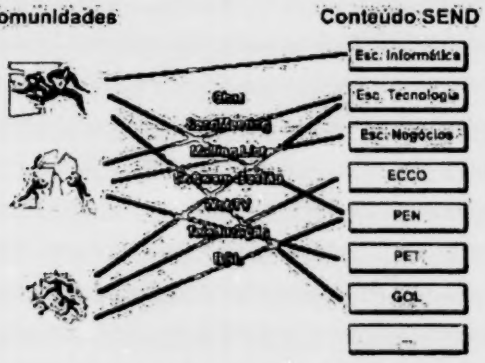

Fig. 1- Knowledge Community concept

Distance Learning programs developed on SEND can now be connected specifically to each knowledge community. It represents the content element of the diagram shown on Fig.1.

Connection elements are SEND services, that represent the interaction ways, giving access and further information for all online students, such as mailing list, WebTV, chat, Online library, all this resources can be used trough the Intranet.

B. Connection Elements

The implementation of interaction tools represents the students channel that enable him to keep in touch with other students and with Online Tutors during synchronous or asynchronous events. These elements must be positioned around the employee and must be accessible at any place.

Teleducation		**Online Library**
Chat		**CD ROM**
Web TV	**SEND**	**Home Access**
Mailing List	**Student**	**Virtual Classroom**
SENDMeeting		**Forum**

Fig. 2- Systems available to an ODL Student

B.1-Teleducation System

The Teleducation System is responsible for all video transmissions on training matters and events, such as lectures and management addresses. Classrooms are spread out at the

B.2-Chat, Mailing List and Forum

These popular Internet applications are available on Intranet to promote interaction for communities on different workplaces. Weekly events are scheduled on chat rooms for each training matter. Mailing list is used to inform news about training programs. Also, student questions are answered by Online Tutors or another student.

B.3-WebTV

WebTV transmits live signal of Teleducation System over Intranet. This application extended Teleducation access to all personal computers of the Company. Also, the same system is used to provide synchronous training to all state, as it will be discussed later.

B.*4-SENDMeeting*

His video Conferencing tool is used to integrate students and Online Tutors using video and audio. Also this service provides virtual Meetings for managers placed on different cities.

B.5-Online Library

Online Library connect students on CRT library pile. It is possible to request and make reservations of books. Library also has a delivery service to avoid employee displacement.

C. Practical Developments

C.1 – Continued Commercial Education

Commercial area professionals of CRT was divided in two communities in order to design the development programs to the follow activities: telesupport and Commercial Outlets.

As characteristics of telesupport team, there is a high turnover level of employees and some non-employees from partners companies. Premisses for development skills of these students is the commitment with the Company by learning about telecommunications business, products & services and costumer needs. This community is developed with the production of instructional materials based on Video on Demand in the format of Learning Objects (small pieces of information for continuous education).

With the use of Learning Objects it was possible to assemble an education path for each student in order to organize an individual professional career.

As a motivational aspect, students feel more comfortable being certified with professional improvements.

C.2 – ADSL Team Community

Implementation of new Telecommunications services motivated the creation of this community specific for Network Installers (see fig3). New professional skills should

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be developed for these teams, since these employees were not skilled in dealing with Computers Architecture and Data Communication. During the installation process of an ADSL (for costumers) they must give all professional information about installation levels in order to reach targets, downloads of documents, contacts with equipments providers, access to Products and Services informations and costumer care proceeding.

Also, the exchange of news and troubleshooting among professionals are shared with the use of mailing lists and forums accessible in a web site specially designed and developed for them.

This process brought to the Company a very successful application of knowledge management. Now, people can share ideas and knowledge and quickly apply this new knowledge on their job, in order to attend company's clients.

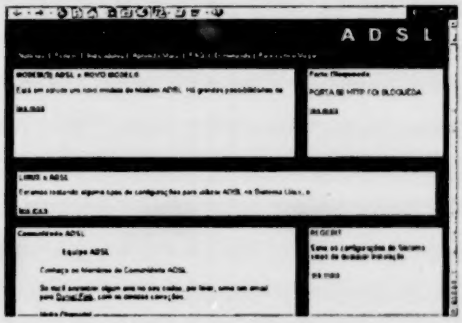

Figure 3 - ADSL Virtual Community

V. SERVICES

Services available on this typical community include : Forum, chat, to learn more, Talk to the specialist and tutorship.

Virtual Communities in CRT have a tutor, which is responsible for that community. This tutor shows a new model of learning-teaching (that came with the concept of virtual communities) : now people bring their needs to the community and other peers can help them in these needs. It is a process where all people are involved and where everybody can teach and, at the same time, learn something .

The old teaching concept had to change: formal tutors are worried about how people work in a virtual community; that means that students became "actors" in their learning process, instead of receiving informations and answering questions.

The virtual community success point is: people have to interact and feel that they are part of the community and responsible for its nourishing and growing and also for the contents' application in the organization.

VI. RESULTS

SEND already trained about 3000 students, on 12 different development titles and 4 distance learning programs. So far, two communities have been formed (ADSL, dealing with technology and leardeship community, dealing with Management issues). There are 80 employees involved with the ADSL community and 150 managers with the Leadership community. For the near future, content development will not be the main success point for a learning organization, but the way students access all contents.

All this training courses were trough the web, people can access them by the intranet of the company.

VII. CONCLUSIONS

Technology development in distance learning is also a technique used to conduct and orient professionals in order to support performance and efficiency on the job. SEND might be the most efficient one for a Telecom Company Environment. The new concept results' showed that people learn more, get more involved and participate more on their own learning process, besides that, this process helps the company to manage it's knowledge and also get more results on it's business very quick.

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Cognitive and Motivational Consequences of Adapting an Agent Metaphor in Multimedia Learning: Do the Benefits Outweigh the Costs?

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Abstract: What are the cognitive and motivational consequences of adapting an agent metaphor in multimedia learning? The present paper reviews a set of studies designed to test the hypothesis that the presence of animated pedagogical agents in multimedia environments can promote deep learning. This was done by first, comparing the learning and motivational outcomes of students who learned in the context of social-agency was to those of students who learned in a more traditional text and graphics context. Second, the particular features of the social agency environment were manipulated to examine which of its attributes are most important in the promotion of meaningful learning. The theoretical and practical implications of the findings are discussed.

Interface Agents and the Learner Experience

Animated software agents figure predominantly in instructional design (Lester et al., 1998). The most common agent interface consists of an animated face, a cartoon character, or a human-like virtual agent who has the task to assist the user, to engage the user into a conversation, to educate the user, or to instruct the user to perform a certain task (Bradshaw, 1997). The argument for using highly visible agents generally relies on the assumption of anthropomorphism-the fact that people unconsciously ascribe mental states to computers and are quite adept at relating to and communicating with other people (Laurel, 1997). However, despite the apparent potential of the agent metaphor, it is necessary to investigate the cognitive and motivational effects of agents' presence in human-computer interaction. Agent design is sometimes centered upon technological capacity rather than research-based principles (Bradshaw, 1997; Genesereth & Ketchpel, 1994; Laurel, 1990; Maes, 1991). As Erickson states, "So far it looks like the agent metaphor is more trouble than its worth...Far more research is needed on how people experience agents...very simple cues like voice may be sufficient to invoke the agent metaphor." (Erickson, 1997, p. 91).

A Cognitive Theory of Multimedia Learning

By beginning with a cognitive theory of how learners process multimedia information, it is possible to make predictions about how the different attributes of an agent metaphor may affect learning. The proposed cognitive theory of multimedia learning is based on the following assumptions: (a) working memory includes independent auditory and visual working memories (Baddeley, 1986); (b) each working memory store has a limited capacity (Sweller & Chandler, 1994); (c) meaningful learning occurs when a learner selects, organizes, and connects corresponding verbal and non-verbal information (Paivio, 1986); and humans actively engage in cognitive processing in order to construct a coherent mental representation of their experiences (Moreno & Mayer, 2000a). In the remaining sections I will offer a set of predictions derived from cognitive theory for each one of the reported studies.

An Environmental Science Scenario

The multimedia learning environment used in this study is based on the computer program "Design-A-Plant", developed by the Multimedia Laboratory at the Department of Computer Science of North Carolina State University (Lester et al., 1998; Moreno, Mayer, & Lester, 2000). In this program, the student travels to an alien planet that has certain environmental conditions (e.g., low nutrients, heavy rain) and must design a plant that would flourish there (e.g., designing the root, stem, and leaves). It includes an animated pedagogic agent who offers individualized advice concerning the relation between plant features and environmental features and feedback on the choices that students make in the process of designing plants. The program starts with the agent introducing the student to the first set of environmental conditions. Then, the agent asks the student to choose the appropriate root from the library of roots' names and graphics shown on the computer screen. After the student had chosen a root, the same procedure applies to the stem and leaves, with the agent first asking the student to make a choice, and giving the student feedback afterwards. Once the student receives the last explanation on the leaves for each environment, he is taken to the next environment. The same procedure follows for the rest of the environments.

Does Learning in an Agent-Based Environment Promote Deeper Learning than Learning Identical Materials in a More Traditional Text-and-Graphics Environment?

To help answer this question, a preliminary study was conducted where the learning and motivational outcomes of students who learned about environmental science in the Design-A-Plant microworld (social-agency or SA group) was compared to the learning and motivational outcomes of students who received identical verbal and visual materials in a text -and graphics environment (no social-agency or no-SA group).

Method and Results

The participants were 44 college students. The computerized materials consisted of two multimedia computer programs on how to design a plant. The SA version was the above described "Design-A-Plant" program, where students see a library of plant parts, pick the plant part that they consider appropriate for the respective environment, and receive spoken feedback in a conversational style from the agent (Lester et al., 1998). The no-SA version was presented with the same library plant parts and explanations than the SA version, but the agent's image was deleted throughout the program. In addition, students in the no-SA version were not allowed to design the plant before reading the verbal explanations, but rather received the explanation directly in a monologue style, similar to when science material is read from a text book.

After interacting with the respective program, participants were tested on three measures: retention--in which students were asked to name as many types of roots, stems, and leaves as they could remember; problem-solving transfer--in which students were asked to solve new problems based on the principles learned; and program ratings--in which students were asked to rate their level of motivation, interest, understanding, and the perceived difficulty and friendliness of the lesson.

Do students who learn interactively with a pedagogical agent show deeper understanding from a multimedia science lesson than students who learn in a conventional environment? The mean number of correctly recalled items by the SA group was not significantly different than the mean number of correctly recalled items by the no-SA group. The results suggest that when retention of factual information is the goal of the program, then environments that allow for interacting with an animated pedagogical agent are not warranted. Although these results demonstrated that both groups learned the basic factual information, students in the SA group did produce significantly more correct solutions on transfer problems than students in the no-SA group ($p < .005$).

The findings are consistent with the idea that students who learn with agents work harder to make sense of the material than do students who learn in a more conventional text -and-graphics environment. This idea was supported by the comparison of students' program-ratings: The SA group rated their motivation to continue learning and their interest in the material significantly higher than the no-PA group ($p < .01$). In sum, these findings give preliminary evidence in favor of using pedagogical agents as software mentors, and demonstrate a *personal-agent effect* in multimedia learning environments: Students are more motivated, interested, and achieve better transfer when the lesson is imparted by a pedagogic agent rather than by on-screen non-personalized text and graphics.

How Do Agent-Based Multimedia Environments Affect Learning?

Reeves and Nass (1996) have provided convincing evidence that students view their contact with computer-based characters as social interactions. Congruent with this approach, students' learning with the pedagogical agent could have been promoted by at least four social-cues: the agent's image, the agent's voice, their interaction, and the personalized language style. The next logical step was to investigate the role that each one of these cues played in the motivational and learning outcomes of the preliminary study. First, to determine the role of the auditory and visual presence of the agent, we varied whether the agent's words were presented as speech or on-screen text and whether or not the agent's image appeared on the screen, both with an animated fictional agent and a video of a human face. Second, to determine the role of the interaction between agent and student, we varied whether or not the student was able to participate in the lesson by designing the plant before receiving the agent's explanations. Third, to determine the role of the language style of the agent, we varied whether or not the agent's explanations were provided in a personalized style (i.e. as dialogue or monologue) both using speech and on-screen text.

The Role of Agents' Visual and Auditory Presence

The main argument in favor of including highly visual agents in the interface is based on interest theory of learning (Dewey, 1913). According to interest theory, students communicate better, become more interested, and therefore learn better and rate more favorably computer programs that include social cues--such as facial expressions or human voices, than those that do not include such cues (Rutter, 1984). Conversely, according to a cognitive theory of multimedia learning (Sweller & Chandler, 1994; Moreno & Mayer, 2000b), the inclusion of irrelevant adjuncts in a multimedia presentation--such as the image of an animated pedagogical agent, may divert the limited cognitive resources available for the processing of the relevant materials. As a result, learning and problem solving will be impaired.

Respect to agent's auditory presence, prior findings on modality effects in multimedia learning found that students learn better from visual and verbal presentations when the verbal information is presented as speech rather than as on-screen text (Mayer & Moreno, 1998, Moreno & Mayer, 1999, Mousavi, Low, & Sweller 1995). The advantages of speech over text have been interpreted as due to more effective working memory and relatively effortless maintenance of the auditory input in comparison to the visual input provided by text (Moreno & Mayer, 1999). Thus, students should perform better on tests of retention and problem solving when they learn with the agent's voice rather than on-screen text. The following two experiments were conducted to examine these hypotheses.

Method and Results

In the first study, 64 college students learned in one of four conditions: with or without the image of a fictional agent who gave narrated explanations to them and with or without the image of a fictional agent who gave explanations as on-screen text. In the second study, 79 students participated in the same four treatment conditions with the exception that the image and voice of the fictional agent were replaced by the video and voice of a human agent. The procedure was the same as for the preliminary study.

Do students who are presented with the image of a pedagogical agent show deeper understanding from a multimedia science lesson than students who are not presented with the image? Experiments 1 and 2 did not provide evidence in favor of either interest theory or cognitive load theory. The results failed to confirm an image effect in program ratings, recall, and transfer: Students who are presented with the image of an agent do not rate the lesson more favorable, recall more, or are better able to use what they have learned to solve problems than students who are not presented with the visual presence of the agent. The image of the agent did not help or hurt students' learning.

Do students who communicate with a pedagogical agent via speech show deeper understanding from a multimedia science lesson than students who communicate with a pedagogical agent via on-screen text? The findings from Experiments 1 and 2 gave evidence in favor of students' communicating with a pedagogical agent by means of speech by demonstrating a modality effect in program ratings, recall, and transfer: Students who learn with the voice of an agent rate the lesson more favorably, recall more, and are better able to use what they have learned to solve problems than students who learn the same verbal information as on-screen text. In both

experiments, the mean program ratings for the narration groups was significantly higher than the mean program ratings for the text groups ($p < 0.05$ for both experiments); the narration groups recalled significantly more than the text groups ($p < .005$ and $p < 0.005$ for Experiments 1 and 2, respectively); and the narration groups gave significantly more correct answers in the transfer tests than the text groups ($p < .0005$ and $p = .0001$ for Experiments 1 and 2, respectively). These results extend prior findings of modality effects in learning from visual and verbal materials to interactive, agent-based multimedia environments (Moreno & Mayer, 1999; Moreno et al., 2001).

The Role of Students' Interaction

Experiment 3 tested the hypothesis that the main attribute promoting meaningful learning in an agent-based environment is students' participation. The goal was to determine whether the effects obtained the preliminary study could be attributed mainly to the difference in the level of interactivity between treatment groups. According to a cognitive theory of multimedia learning, a central part of the learning process occurs when students attempt to apply the instructional material to solve problems for themselves (Anderson, 1983; Moreno et al., 2001). Experiment 3 compared an agent-based computer lesson where students were able design a plant for each environment before listening to the agent's explanations, with an identical lesson where students were not able to design plants during the interaction but rather listened to the agent's explanation directly.

Method and Results

The participants were 38 college students who learned with or without participating in the process of plant design. After being introduced to each environment, students in the participatory version (P) clicked on a plant part to design a plant before listening to the agent's explanation. Students in the non-participatory version (No-P) were presented with the same plant library but clicked on a "continue" button before listening to the same explanation. The procedure was identical to that of the prior studies.

Do students who participate in the process of plant design show deeper understanding than students who learn with no participation? The results supported a cognitive theory of multimedia learning by demonstrating an *interactivity effect* in recall and problem-solving transfer: Students who learn by participating in the learning task with the pedagogical recall more and are better able to use what they have learned to solve far transfer problems than students who learn in a non-participatory agent-based environment. The P group recalled significantly more ($p = .01$) and gave significantly more correct answers in the far transfer tests ($p = .04$) than the No-P group. However, groups did not differ on program-rating scores. Overall, the findings are consistent with a cognitive of multimedia learning and allow us to conclude that participatory environments encourage the deep processing of the materials of a lesson by engaging students in an active search for meaning (Moreno & Mayer, 2000a).

The Role of Agents' Language Style

Past research has shown robust evidence for a phenomenon called the *self referential effect*, in which retention is facilitated by having people process information by relating it to aspects of themselves (Rogers, Kuiper, & Kirker, 1977). In Experiments 4 and 5, self-referencing was created by a personalized style of communication, where students were addressed directly and encouraged to believe that they were active participants in the lesson. According to a cognitive theory of multimedia learning, self-referencing may promote deep learning in two ways: first, by engaging students in the active elaboration of the materials and second, by using less cognitive effort to process verbal information when it is presented in a familiar style (i. e., normal conversation) rather than an unfamiliar style (i. e., monologue) of communication.

Method and Results

In Experiment 4, 39 college students learned either with a personalized conversation spoken by the agent or a non-personalized monologue spoken by the agent. In Experiment 5, 42 college students learned either with a personalized conversation displayed as text or a non-personalized monologue displayed as text. The procedure was identical to that of the prior studies.

Do students who communicate with a pedagogical agent via a personalized dialogue show deeper understanding than students who communicate via a non-personalized monologue? The findings from Experiments 4 and 5 gave evidence in favor of students' communicating with a pedagogical agent by means of a personalized conversation by demonstrating what w have called a *self-reference effect* in recall and transfer: Students who learn by communicating with a pedagogic agent via a personalized dialogue recall more and are better able to use what they have learned to solve problems than students who communicate via a non-personalized monologue. The mean number of ideas recalled for dialogue groups was significantly larger than for monologue groups ($p < .005$ and $p < .05$ for Experiments 4 and 5, respectively) and the mean number of correct answers in the transfer test was significantly larger for the dialogue groups than for the monologue groups ($p < .0001$ for both experiments). In addition, Experiment 4 demonstrated a self-reference effect for program ratings. Students who learn via on-screen text rate the program more favorably when it is presented in a dialogue rather than a monologue style ($p = 0.05$).

Conclusion

The reported results supported a cognitive theory of multimedia learning when three social cues are present in the interface: the agent's voice, a personalized language style, and students' interaction. Based on the assumption of limited cognitive resources, it was predicted that the introduction of the agent's image in the computer interface would be detrimental to students' learning. This prediction was not confirmed. According to cognitive load theory, a detrimental effect in learning occurs in the cases that students need to split their attention between mutually referring materials (Sweller & Chandler, 1994). However, in our studies, the agent's animated image was never presented simultaneously with other visual materials of the lesson. It is more likely that multimedia presentations containing simultaneous animations of the agent and graphics or text, would result to be detrimental rather than neutral to learning (Mayer & Moreno 1998, Moreno & Mayer 1999).

On the other hand, several interpretations can be offered to explain the lack of an image effect. First, the voices used for the fictional and human agents in the first two experiments were extremely clear and expressive. When voices carry these qualities, it is less likely that facial expressions or lip movements will be helpful in understanding the instructional message. Second, if the goal of the instructional material is to teach procedural knowledge, such as how to make a machine work, the use of an agent's image and gestures might play a crucial role by supplementing a conversation with pointing actions and gaze (Hanne & Bullinger, 1992). Third, the lack of an effect may reside in the scientific content of the lesson. It might be that for other subjects such as social sciences, learning with the image of an agent plays a fundamental role. Faces for example, can add vital information about the intensity and valence of the social events described (Ellsworth, 1975). More research is needed to investigate the role of agents' visual presence in other multimedia learning situations.

On the practical side, the present study has direct implications for instructional design. The reviewed studies offer encouraging evidence for using social-agency environments in instructional design. Multimedia programs can result in broader learning if the visual materials are combined with personalized spoken explanations, especially when the student is made a participant rather than an observer of the learning environment.

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Impacts of The Internet on Latin America.
Latin America to Lead The Way in e-Business.

Abstract.

"The world will be turning to Latin America for guidance on E-business applications and methodologies. We are seeing traits and dynamics in some of these markets that many more established economies aspire to in this accelerating age of technology.... It is interesting to observe the common trends that are occurring in the e-business environments. In the last 10 years we have seen that the economies who develop the technology and strategies are often the slowest to adopt them and apply these principles..... The willingness of some of these advanced economies in South America to adopt new business strategies and methodologies and to innovate and experiment with business ideas are key accelerating factors in the shaping of true global e-business. "

Introduction.
The world will be turning to Latin America for guidance on E-business applications and methodologies. We are seeing traits and dynamics in some of these markets that many more established economies aspire to in this accelerating age of technology. The willingness of some of these advanced economies in South America to adopt new business strategies and methodologies and to innovate and experiment with business ideas are key accelerating factors in the shaping of true global e-business. A brief look at Chile's pension scheme is testament enough to prove its commercial and cultural dynamics are attuned to accept new regimes and methodologies and implement them rapidly. The European and Anglo-Saxon developments in technology are having the greatest impacts where businesses drop existing structures and completely re-engineer not only the processes but re-examine their mission statements and objectives.
By examining trends that have been emerging over the last ten years we can see that ability to swiftly adopt new business practices greatly increases market share and productivity. A hindering factor in this process is the reluctance of existing enterprises to step outside their existing business practices.

Acknowledging the trends.

When we consider that we really have less than a decade of experience of case studies in which to examine the impacts the Internet has had on business, it is little wonder that action has been reactive. We must be aware that trends have emerged and are already repeating themselves as new technology and IT tools become available to us. There are however, sufficient repeating cycles within this short space of time to send a clear signal to the business world that we need to take action very soon.

Let's look at a couple of these trends.

In the early Nineties as point and click browsing began to become commonplace, the Internet was still seen as a way of mass communication and an enabler to overcome some of the oppressive reigns and dogmas of the global society. It was hailed as the true open and uncensored communication of the planet. It was encouraging and allowing the true voice of society to be heard, exchanged and be understood. When the commercial trend began emerging as a dominant feature of the Internet there was resistance by those who had originally exonerated its potential. The thought that the Internet was going to be used as another commercially driven mass marketing machine was a horrid and unacceptable to many. The fact however was that it was following exactly what its creators had set it up to do, it was following the true trends of societies. In short they had accelerated a huge unstoppable momentum that was following a path that many thought and hoped it would not. In Australasia there were many uncomfortable exchanges between the predominant Internet users of the day and the ISPs who were trying to establish the Internet as a business tool. There was no question about the direction it was going. The Internet community of the day were unaccustomed with their own philosophies and still looked to traditional areas to blame this new trend onto. It was a case of "the Internet will follow any path it chooses to and that's fine as long as it is what we thought it would be." The truth was that the Internet community of the day was unable to follow its own philosophies.
We see this same pattern emerging in other areas today nonetheless in education and more so in the economic dynamics of the developed global marketplace.

As business began making use of some of the tools that this technology provided there was still a very slow reaction from the larger telecommunications companies. They were slow in accepting that the Internet and its associated applications would affect their core business. The interest and focus of the telecommunications companies was related to bandwidth and clipping the data ticket. Their acceptance that the Internet would seriously impinge on their core income took a while to sink in. The focus was on the technology rather than the impact technology would have on the commercial world.
This trend has continued over the past six years and business now is just starting to realise that technology as an automation tool is not capitalising on its true potential. Those in emerging markets who have been quicker to adopt and practise the new paradigms are superceding businesses in the developed markets.

During this phase the tertiary institutions began to scramble to provide courses on web page design, cgi scripting, html and programming. Virtually no effort was put into analysing the impacts that this new technology may have on business and society in general. By 1996 the telecommunications companies in Australasia had realised the impact this new technology was having and set

about to teach their own cumbersome enterprises how to dance to these new tunes. From within their existing structures they began to offer Internet connection and web services. Unaccustomed to such a high number of technically oriented customers the telecommunications companies struggled to provide the level of service and dynamic response times the customers were demanding. Even now, they are only beginning to look at customer customisation and providing service to their commercial clients in any meaningful way. Their challenge is, and will be until they restructure their approach to technology services, that their business processes and systems are in the old age formats and will never be sufficiently nimble to cater for the e-business customer. Even with the resources, networks and cash flows that these large companies have, they have been unable to keep up with the beast they have helped create.

E-business now is challenging very core of our traditional business methods. Commercial entities in the IT area are becoming increasingly conscious that they must be the first to re-engineer their practices and approaches if they are to remain in any position whatsoever to cater for the new wave of business emerging now. Emerging businesses are embracing the wonders of the new age E-business more quickly in the emerging markets.

E-business not IT.

The major difference in the established economies was that technology was being used to automate existing processes. In the emerging markets such as Latin America technology is being applied by businesses to completely restructure the way business is being conducted. Just when it seemed that the average business was considering putting static content online, e-brochuring and e-tailing, a small percentage used the new tools to completely re-engineer their businesses. They went in competition with longstanding traditional household names and for a fraction of the set up costs became significant market forces in traditional market areas. In this small percentage of businesses, Extranets are being used to outsource in a collaborative way; the focus is on core competencies; old competitors are becoming valuable members of their business value chain and most importantly the Internet is being used to develop customer led, commerce.

Even IBM recognised that e-business had began to cut an unrelenting swath through the commercial world. It also realised that re-engineering its own systems could not be done from within its existing structure. With all its technical capabilities IBM set up a stand-alone business unit armed with leading business acumen and an understanding of the latest technological tools to begin e-business operations. [1]

The Latin Advantages.

Latin America has some distinct advantages that explain why the rate that it is adopting e-business strategies is high.

-Government policies.

Some of the governments of Latin America have acknowledged that technology is an enabler to their economies. When ambassadors and consulates are posted overseas they are often backed by diplomats with a specific purpose of facilitating education and technological ties with the host country. New Zealand was identified as a country with quality education systems and a country that is developing niche IT solutions. Accordingly the Chilean government posted a diplomat with the specific responsibility of education and technology to New Zealand.
This clear willingness to seek out, analyse and if necessary, adopt new technologies or methodologies is a mentality that accelerates the uptake of e-business in any environment.

Whilst many economies are adopting open trade philosophies both England and the USA continue with protectionist policies. These will ultimately hinder the global e-business infrastructure which is based on open two-way trade and communication.

-Willingness to change.

This cannot be under stated. In the States, Europe and Australasia we have been accustomed to functioning democratic hierarchial structures both in government and in a business context. When technology first became available to us in a significant form we immediately used it to automate many of our existing processes. Even now when the leading Masters degrees are teaching businesses to use technology as an enabler for change we resist questioning and de structuring our existing business practices. This reluctance to let go will be the reason that we will look to Latin America in a few years time on how to restructure our own entrenched businesses.
The Latin economies are hungry for technology and change. It is this mentality and willingness to drop the old and try the new that will enable e-business to quickly establish and function in these areas. These attributes are the key and critical success factors for re-engineering any business. They are professed by the business schools and IT management programs around the world. Some of the Latin economies are willing to put into practise what many other economies are not. It is ironic that these teachings and technologies have emerged from the more established economies yet, they are slow to implement their own advice.[2]

-Culture.

Western economies have been through the phase of government control, de-regulation, the contract hire and fire regime and now with the impacts of E-business and technology we are having to rely more and more on basic trust and faith in relationships to enable effective commercial collaboration. Being very individualistic societies, dropping of the guard is posing as a barrier to the implementation of true e-business philosophies.

The Latin culture is more comfortable with the collaborative relationship based approaches to business and life in general. These traits again are core to the effective implementation of e-business philosophies. Therefore the acceptance and integration of these philosophies is not foreign. The result is that the Latin culture has another obstacle less to overcome than their counterparts in more established economies.

Further to this governments in Latin America are encouraging and fostering a type of business culture that welcomes partnerships, collaboration, joint ventures and acceptance of new ways of doing things. This is contra to some of the philosophies of some of the established economies, who take a more arrogant and inward approach. I believe this is very dangerous in today's day and age because I see IT affecting change in our commercial structures at a rate that has not ever been experienced in our history. Attitude and flexibility are key competencies in today's technological marketplace. No business culture can afford to rest back on its laurels and enshrine its existing philosophies with-out putting the enterprise (or economy) at risk.

Summary.

It is interesting to observe the common trends that are occurring in the e-business environments. In the last 10 years we have seen that the economies who develop the technology and strategies are often the slowest to adopt them and apply these principles in their own backyard. The result is the global leveling in trade, business and technology where emerging markets will soon become the leaders in application of technology reaping the rewards.

Unlike the agricultural or industrial revolution it's very difficult to go back on technology and say look we did that wrongly, let's start again. The by-products of the agricultural and industrial revolutions were things like deforestation and environmental impacts, things that can be redressed and mitigated after the event. Compare this to the technological revolution where education is the by-product and its influence and impacts are on the global society. As emerging markets become more nimble and embrace new technologies the rate of education and advancement will only accelerate further. The time is close when the Latin markets will be teaching establish markets on how best to go about their change processes. We have already seen it in the pension reform area. Imagine then the rate of uptake of these new business paradigms. Over the next few years we will all be looking to Latin America for direction.

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CREATING OR CLOSING THE GAP?
Using a digital based e-learning package in two different pedagogical and social contexts

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Abstract: The aims of the project was explore (1) the types of experiences students have of their learning processes; (2) the role of tutoring in learning process and finally (3) how the students construct interaction in learning process. This package was delivered in two ways. Full time students had some introductory lectures, which were supported by the learning material and tasks in the package. The adult students had a short introduction to the course and they got the package on CD, for home installation. The preliminary analysis of the data from these two groups doesn't show any meaningful differences in learnin g outcomes, but there were some differences in the pedagogical and social processes.

Background of the project

The students are different and they have different learning experiences in their history. This paper is a part of developing project which explores two different ways of learning. Context of this project was English language course for post graduate nursing students (English as a foreign language). The rapport explores the use of two models of digital materials (CD-rom and Intranet version) as part of an e-learning training package. A case study, drawn from with the Finnish healthcare education system, provides the opportunity to examine.

Aims of the project

was to explore:

1. The types of experiences students have of their learning processes
2. The role of tutoring in learning process
3. How the students construct interaction in learning process

Sample and the methods

In Finland there are many different types of student nurse groups. The largest group is made up of young college students (aged 19-23). However, promotion of continuing education opportunities has resulted in a growing group of adult students, who study mainly on a part time basis. New technologies are affecting the education of both groups. Whilst, the traditional

(19-23 group) perhaps have greater IT-skills than the adult students, they appear to be less motivated to use these skills for self directed study.

The digital e-learning material used in this project has been developed in Turku Polytechnic. The research case focuses on the use of a learning package that at one level is concerned with the family-oriented care of acute psychosis, but which allows, at another level the simultaneous study of English as an 2nd language. The learning package is contextually situated in the wider mental health field, and is structured around seven main topics that focus both on the practice of psychiatric care and the use of the English language.

The learning package has four purposes. Firstly, it can be used in the professional study of psychiatry and mental health nursing at medical and nursing schools. Secondly, it is suitable for independent distance learning by social, medical and nursing staff. Thirdly, this learning package is classified as ESP-material (*English for Special Purposes*). This material is particularly suitable for foreign speakers in English-speaking regions and for student nurses in countries like Finland.

Finally, this CD ROM program can be used in psycho-educational training by all service-user groups. The structure of the program has been made so clear that it is easy to analyze the background of psychiatric disorders. This program enables the patient and his/her relatives to understand the premises of psychiatric care.

Procedures

This package was delivered in two ways: (1) Full time students had some introductory lectures, which were supported by the learning material and tasks in the package. The package was made available across the college network. Students got 'face-to-face' tutoring from named tutor and returned completed exercises as paper version. (2) The adult students had a short introduction to the course and they got the package on CD, for home installation. They had e-mail connection to the tutor. They sent the exercises to the tutor as attached files in e-mail.

Results

The preliminary analysis of the data from these two groups doesn't show any meaningful differences in learning outcomes, but there were some differences in the pedagogical and social processes. However, both groups utilized and considered the various social support processes, to be more important than the pedagogical processes involved in the different delivery of the learning package. The implications of this for future e-learning initiatives are discussed.

Using An On-Line Discussion Board in a Student Collaborative Learning Experience

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Abstract: A graduate course in special education was modified from a traditional course to an Internet Assisted course by the introduction of Blackboard Course software. The purpose of this study was to examine whether the introduction of on-line discussion boards improved the learning experience of students. Pre and post course surveys revealed that the students improved their computer skills and liked working on the Internet, and reported that after the course on the computer they were more comfortable using a computer as a learning tool in an Internet assisted environment.

A graduate course in special education was modified from a traditional course to an Internet Assisted course by the introduction of Blackboard Course software. The course, in traditional mode, offered students opportunities to collaborate on assignments and readings. The course, in Internet Assisted mode, incorporated Blackboard's discussion boards to enhance student collaboration. The purpose of this study was to examine whether the introduction of on-line discussion boards improved the learning experience of students in the course. Did the students report any difference between their experiences in a traditional course and this course?

Research indicates that a collaborative environment in a traditional classroom increases student motivation and achievement, and creates a more productive learning experience by promoting the use of higher thinking skills (Comeaux and Nixon, 2000). Research on on-line environments has found that well-planned teaching environments support active learning techniques such as peer interaction and collaborative learning activities (Rogers, 2000). Collaboration is strongly advocated as an effective instructional on-line strategy.

The emerging teaching environment is based on customization, collaboration, and interaction where instructors guide students to appropriate materials, manage interaction among learners, and monitor the learning process (Brown, 2001). But some of the literature reports that most students do not view on-line instruction as a replacement for traditional classroom instruction (Cooper, 2001).

The introduction of Blackboard gave a class of twenty graduate education students an opportunity to interact and collaborate on contributions to the class. The Blackboard discussion board offered students an asynchronous environment and a more flexible opportunity to work with each other and contribute to each other's knowledge. The project allowed students to learn new technology skills. The Blackboard discussion board was accessible from the Internet. The students were given accounts to log on to the site of the course. Students could reach the site at any time of the day and from any place where they had access to a computer connected to the Internet. This brought the learning experience to other places: home and the workplace.

Students were instructed to respond to reading assignments by placing their analysis and summaries of these readings on the Blackboard discussion boards. Groups of two or three students would collaborate on a summary and post that response in a designated discussion area. Their colleagues were required to post a response to the summaries in the form of a critique on the boards. The course instructor also responded to the summaries. The summaries and responses were available to the entire class.

The students took electronic on-line surveys (Milbrath and Kinzie, 2000) on the Blackboard site before and after the course to tap pre and post course attitudes toward the course and toward technology. The pre and post survey questions covered perceptions of competence with the computer, the Internet, e-mail, and discussion boards as well as attitudes toward the instructor's role and their comfort level inside an Internet Assisted course. The results of the surveys were compared to determine whether students' attitudes and satisfactions changed.

Summary of the Findings of the pre-course and post-course surveys:

The Blackboard program, which produced descriptive statistics, handled the survey responses.

Nineteen students responded to the on-line pre-course survey and eighteen students responded to the post-course survey which were housed in the Blackboard test area. In summary, the pre-course survey data seem to suggest that the students entering the course held traditional views of the classroom and instructor role while expressing optimism about their use of technology. Almost half (47%) of the students thought it was somewhat important to have the instructor always present in the classroom. Almost 1/3 (31%) thought it was important or very important. About 1/5 said it was less than important. The post course survey responses mirrored the pre-course perceptions.

The discussion boards are vital for interaction and collaboration among the students. In the pre-course survey, slightly less than half (48%) thought their competence with electronic discussion boards was below fair. Only 26% thought their competence was better than fair. Since 95% of the students rated their general computer competence as fair or above, the discussion board question may have caught them by surprise as new, unfamiliar technology. In the post course survey data, all students thought their competence on the discussion board was fair or better with 56% rating it as good (up from 5%). All students rated their overall computer skills as better than fair with 61% rating them good (up from 32%). The post course data revealed that students improved their computer skills and liked working on the Internet and reported that after the course on the computer they were more comfortable using a computer as a learning tool in an Internet assisted environment. Confidence in Internet skills was up 32 percentage points and 34% reported enjoying the experience over a traditional course. But when asked what percentage (from 100%) of their learning came from discussions and presentations with classmates, the perceived estimates (pre-course survey) and actual reported amounts (post course survey) varied (upward) by only 6%. It appears that students didn't draw a strong connection between their increased competence on the discussion boards and collaboration on the boards, perhaps because collaborative exercises were already part of the traditional course. This area warrants more directed questions and study.

The literature indicates that student performance in an on-line course will be similar to that in a traditional course; that student evaluation responses on an on-line course will also be similar to those of a traditional course (Gagne and Shepherd, 2001). Our pre and post surveys show our students' responses coincided with the literature findings.

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ACTIONS for Interactions: Web Tools on a Shoestring Budget

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Abstract: This paper addresses the selection of appropriate Web tools for instruction and communication in Web classes on a shoestring budget. The selection criteria are Bates' ACTIONS model: Access, Cost, Teaching functions, Interactivity, user-friendliness, and control, Organizational issues, Novelty, and Speed. This case study presents a graduate class investigation of and recommendations for applications of Web tools for use in a Web-based class.

Introduction

The Web has become a powerful force in higher education, both as an adjunct to face-to-face and distant-delivered instruction as well as the primary mode of communication. We are witnessing an influx of such institutions as the University of Phoenix and NOVA Southeastern University, which teach online courses throughout the United States. Some higher education faculty are pressured to teach courses online, whereas others recoil from changing the status quo. The recent evolution of technology has encouraged higher education institutions to designate funds for technology; however, individual instructors must implement these technologies into the classroom on a shoestring budget. In 1997, "integrated distributed learning environments" (IDLEs) were being announced as integrated Web tools that mirror the instructional process (McGreal, 1998). IDLEs, which are accessible via common Web browsers (e.g., Netscape, Internet Explorer), include FirstClass and WebCT. At that time, although many instructors published their syllabi on the Web and used the Web for enrichment purposes, few instructors used Web software applications for communication with their classes.

How are decisions made concerning the selection of inexpensive Web tools to facilitate communication within a Web-based course? To respond to this question, we profile and explain Tony Bates' (1995) ACTIONS model, a methodology for selecting appropriate instructional tools.

This paper discusses criteria for selecting appropriate and inexpensive instructional Web tools. In today's educational environment, budgetary considerations are paramount. Detailed below are each of the criteria outlined by Bates and the questions we addressed in choosing appropriate tools. The case study focuses on the need to adopt either a single tool or a set of fully online instructional applications. We asked the following questions prior to the beginning of the 1997 class in which the solutions were derived:

- What Web tools are appropriate for teaching the required content in a Web-based class?
- What methods should be used to provide students with training on the Web tools?
- How can we use the Web as the sole source of interaction and communication?
- How can we implement the use of Web tools on a shoestring budget?

The paper consists of these sections: 1) the ACTIONS model for selecting and using technology, 2) the specific Web tools used, 3) sequence of Web tool investigation, and 4) recommendations for selecting and using technology.

ACTIONS Model

In this case study of a 1997 graduate class at Texas A&M University, the students themselves investigated various Web tools and then developed guidelines for using and maintaining the tools. The students

recommended specific Web tools to be used in a subsequent Web-based class. The ACTIONS model (Bates, 1995) provides a methodology for decision-makers to reach conclusions about selecting and using technology for distance education settings. The ACTIONS factors are access; cost; teaching functions; interactivity, user-friendliness, and control; organizational issues; novelty; and speed. Each of these factors is described below in the context of the case study.

Access

"No matter what the quality of the teaching material, it will not teach if learners do not receive it" (Bates, p. 36). Students must be able to retrieve and use the software applications and teaching materials easily and cost effectively. Access issues include location and flexibility. The issue of location was resolved by deciding to use Web tools that would not require peripherals such as cameras or microphones. As a result, the students could retrieve and use the tools and teaching materials from computers at home or work.

Flexibility affects access in at least two ways. First, flexibility is related to providing stable and multi-platform applications. Due to some students' use of PCs and others' use of Macs, we determined at the outset that any Web tools selected would operate on both platforms. Second, flexibility is concerned with such external issues as firewalls. Many universities and corporations use firewall systems to protect their software and computers from attack by allowing only the information that the administrator decides should pass through it. The Texas A&M University firewall prevented some off-campus students from accessing certain Web tools until the telecommunications specialist placed the software outside the firewall.

Cost

To address the important topic of budget, we focused on Web applications that were free or inexpensive and required little or no initial investment of time. A summary of Bates' understanding of costs, and how costs influenced our choice of Web tools, is presented below.

In conventional education, the budget for capital purchases is used to cover fixed costs (costs that do not change with output), which are expenses associated with the purchase of capital items such as buildings and equipment. Operating budgets cover variable costs (costs that change with output), or those expenses associated with supplies and salaries for teaching and administration. Bates argues that administrators often pay production costs for course materials out of the operating budget when the materials last longer than the equipment used to produce them (e.g., course materials often have a shelf life of eight to ten years). In conventional education, teachers are a variable cost (more teachers are required for more students), and two-thirds of conventional education's costs are variable, depending upon the number of students.

In many distance education cases the opposite is true, depending upon the specific technologies used. In distance education the majority of fixed costs are is on producing course materials, whereas the variable cost is the cost of delivering the instruction to the student (e.g., videotapes, audiotapes). Therefore, creating a new distance education course has a high fixed cost for more expensive technologies like interactive compressed videoconferencing, but low variable costs when spread over time and many students. Bates' description of costs was echoed in a case study that compared costs of development and delivery of a university Web-based course with those of similar face-to-face courses (Harapnuik, Montgomerie, & Torgerson, 1998).

In this case study, we had the best of both worlds: we had low fixed costs by upgrading existing computers and using free software, and low variable costs by providing the students with inexpensive or free access. The instructor obtained a $3,000 university grant to supply hardware, software, and stipend for a telecommunications specialist. A departmental contribution provided for the graduate assistant. Because budget constraints prohibited purchase of a new computer, we upgraded an existing computer to be the Web server, for less than $1,000 in 1997. Thus, the Web server and all other software used in the class were entirely free.

Teaching and Learning

According to Bates (p. 43), three critical questions need to be asked about teaching and learning:

1. What kinds of learning need to be developed?
2. What instructional strategies will be employed to enable the learning needed?
3. What are the unique educational characteristics of each technology, and how well do these match the learning and teaching requirements?

To address these questions, instructors must identify what type of learners they are trying to reach, "since the choice and use of technology should be driven by a coherent and conscious view of how people learn" (Bates, p. 44). Instruction may be primarily behavioral, cognitive, or constructivist, or a combination. In constructivist learning environments, for example, learners construct knowledge in context based upon their interpretation of experience and previous knowledge structures. Garrison (1993) argued that to extend beyond assimilation of prescribed information typically found in the behavioral mode, cognitive constructivists use instructional strategies that facilitate active learning through dialogue with oneself and others.

Computer conferencing is increasingly the means by which "learners actively construct knowledge by formulating ideas into words that are shared with and built upon through the reactions and responses of others" (Harasim, Hiltz, Teles, & Turoff, 1995, p. 4). Instructors must determine instructional strategies and asynchronous and synchronous tools that are appropriate for teaching the content. In the case study, students needed an easy-to-use threaded discussion area to discuss topics, ask questions, and reply to comments and questions. To work collaboratively to develop a product, they also needed to have shared workspaces to write and edit each other's documents as well as share graphics and other types of files. Using email instead of a shared workspace would have been insufficient to develop collaborative projects because of the need to maintain files in shared folders, compare versions of documents, and make comments based on recent edits.

Interaction, User-friendliness, and Control

Garrison (1989) identified two-way interactive communication as a critical feature of the educational process. In distance education, this communication takes place via technology and is embedded in instructional methods that provide for interaction. Interaction in distance education typically occurs between the learner and the content, the learner and the instructor, the learner with other learners (Moore, 1989), and the learner with technology, or "user-interface interaction" (Hillman, Willis, & Gunawardena, 1994), which is critical particularly with high technology communication devices. Interaction and ease of use allow students to overcome technological difficulties and devote critical learning time to content. User-friendliness encompasses the ability of students to use each tool easily and even encourages discovery of additional capabilities of the tool based upon experience with its use. Learner control allows students to organize their study and learning time in a more flexible manner.

The students in the case study engaged in the four types of interaction through critical thinking and active learning as they completed their course requirements. Student-technology interaction took place in the investigation of the Web tools, which led to their accomplishing a significant portion of the other three types of interaction. Student-content interaction took place as the students as individuals or in pairs used the tools to develop instruction, thereby determining the functions and capabilities of the particular tool. This activity informed their use of the tool to develop instruction for the other class members. Student-instructor interaction occurred with both the instructor and graduate assistant face-to-face and via computer conferencing for feedback on the case studies and Web tool investigations. Students also sought information about software and hardware requirements and management issues from the telecommunications specialist. Student-student interaction occurred at length as the students used the tools and learned the capabilities of each tool. Students met virtually to experiment with the tools and to discuss their case studies (Murphy, Harvell, & O'Donnell, 1998).

Organizational Issues

Organizational issues include administrative requirements oftentimes resulting in barriers imposed on the educational process. Resistance to change and a reliance on existing technologies are some of these barriers. Throughout Texas A&M University in 1997, faculty were being encouraged to develop innovative techniques for incorporating technology and telecommunications into their instruction, and an Office of Distance Education was being formed. The development and instructional team for the class in the case study consisted of the instructor, telecommunications specialist, and graduate assistant.

Novelty

The use of new, innovative technologies may encourage funding agencies to invest more into the educational program. In addition, the application of new technologies can stimulate change and development in institutions that previously maintained predictable and sometimes "stale" educational programs (Bates, p. 59).

Speed

The speed factor relates to the ability to acquire educational materials quickly and to maintain educational material over time. Institutions are often reluctant to develop new technologies and materials that will cause substantial maintenance time and money in the future. Recognition of and planning for future expenditures will increase the institution's ability to convince instructors, administration and funding agencies to risk the initial investment of time required to get a new technology or course off the ground.

Web Tools

The instructor selected four Web tools for the graduate class to investigate; she determined that the functions needed for teaching content in the subsequent Web-based class should include: asynchronous conferences and synchronous chat areas, a threaded discussion board, and a shared workspace for students to write and edit collaborative documents as well as share graphics with each other. The required characteristics of the tools included stability, inexpensive or free, multi-platform, easy to use, accessible via the Web, and able to be password protected. The instructor decided that together the tools must provide for all four types of interaction: student-content, student-instruction, student-student, and student-interface. The telecommunications specialist located the following tools, ordered from simple to complex.

WWWBoard—This Web discussion board allows students to engage in asynchronous discussions that are threaded and thus easily organized. The Web board is a discussion forum and a message board that can be viewed in its entirety. Users can post new messages, follow up on existing ones, and search for a string of characters within messages.

Easy Web Group Interaction Enabler (EWGIE)—This chat function allows students to hold synchronous chats with others and use its whiteboard capabilities. This Java-based application allows for multiple rooms and lets people follow others to wherever they go on the Web. Users can have discussions in preexisting rooms or in rooms that they themselves create.

A Multi-user Domain, Object-Oriented (MOO)—A type of MUD on the Web, this tool allows students to have synchronous Java-based chats with others in both private and more public virtual reality environments. Users can adopt a persona, or personality.

Basic Support for Cooperative Work (BSCW)—This shared workspace enables students to write and edit collaborative documents as well as share graphics with others. It allows the storage and retrieval of documents and the sharing of information through its hierarchical structure of folders. The graphical interface allows users to negotiate the system using icons and menus.

Each of the Web tools was freely available for general use or had an academic clause in its license documents. After investigating each of the tools, the students recommended that we eliminate the MOO for the subsequent Web-based class and use the other three tools.

Sequence of Web Tool Investigation

The instructor designed and developed the course with this particular Web tool investigation in mind, although she had taught the course twice previously. She was the "guide on the side" in her role of facilitating the process of discovering capabilities and limitations of Web tools while maintaining the integrity of the course. The graduate assistant helped the instructor in the Web page presentation of course materials and advised students in using, writing, and publishing guidelines for the Web tools. The telecommunications specialist acted as a "keystone" for the students and the instructor in his role of: 1) selection of web tools, 2) server hardware and software setup, 3) hardware and software administration, and 4) student and instructor support in using and administering server and web tools.

The instructor designed the following procedures for the students. The students either worked alone or with a partner to investigate one web tool at a time over a three-week period during the semester. Each three-week block was divided into three class sessions: Week 1: training on the web tool (held face-to-face), Week 2: doing assignments using the tool, and Week 3: evaluating the tool. For weeks 2 and 3, the students met via interactive compressed videoconference and used *FirstClass* computer conferencing (which was expensive

software and not Web-accessible at the time) for communication between class sessions. The Web tool investigations involved these six steps:

1. Use Web-based Tools

Each student or pair of students selected a web tool to investigate. The trainer students became experts in using their designated tools. By using the tools before their unit began, the trainer students discovered and overcame access difficulties and software interface peculiarities.

2. Train Others on Web-based Tools

By developing expertise with their Web tools, the trainer students developed a training program and wrote preliminary guidelines. During the first of the three sessions allocated to the tool, the trainers introduced the tool, demonstrated its use, and provided guided hands-on experience. While the trainees practiced using the tools, the trainers identified problem areas needing clarification before finalizing the training guidelines. The trainers encouraged the trainees to identify appropriate instructional applications for each tool.

3. Plan and Implement an Instructional Application of the Tool

The trainers were responsible for planning an instructional unit, conducting instructional activities, and moderating the online discussions that took place during the last two weeks designated for their tool. During this period, the trainees carried out the instruction using the tool and thus identified which tools would be appropriate for teaching a particular type of content, based upon the capabilities and limitations of the tool.

4. Administer the Tool

The trainers interviewed the telecommunications specialist regarding such management issues as computer and server requirements and costs of the tool. The telecommunications specialist helped the trainers identify important factors in making recommendations for adopting and using Web tools.

5. Publish Information about the Tool

The trainers wrote guides for their tools. Each guide includes a general overview, user guidelines, server and client requirements, FAQs, links to the software developer, costs, example links, and illustrations of real-life applications of the tools. In some cases, the trainers developed a test workspace for users to practice using the tool. These guides were subsequently published:
WWWBoard Guidelines: http://disted.tamu.edu/tools/wwwsumm.htm
EWGIE Guidelines: http://disted.tamu.edu/tools/ewgie.htm
BSCW Guidelines: http://disted.tamu.edu/tools/bscw.htm

6. Evaluate the Lesson and the Tool

The students collaboratively developed an instrument to evaluate web tools, using the seven factors of Quality Distance Education <http://www.uwex.edu/disted/qde/home.html>. They published their instrument *Evaluation of Web-based Instructional Tools* <http://disted.tamu.edu/forms/webtools.htm> and used it to evaluate the various Web tools and each other's instructional units.

Recommendations

Access - Choose technology based upon access by all students.

Cost - Attempt to use free or inexpensive tools (if extra money is available, use it for other purposes).

Teaching functions - Select the most efficient and effective applications (efficient in terms of time, cost, and effort; effective in terms of the outcomes meeting the learning objectives).

- Begin training using the most simple tools and build up to the more complex ones
- Teach only one tool at a time
- Develop an in-depth technology training program incorporating hands-on practice with the tools and taking place as an orientation at the beginning of the session
- Have experienced users help with the training program
- Give the students a chance to play with the tools in a game-like activity instead of using the tools immediately for content purposes at the beginning of the semester

Interactivity, user-friendliness, and control - Provide for tools that offer all types of interactivity, ease of use, and control by the student.

Organizational issues - Obtain and maintain support by administrators and technology specialists. The setup and maintenance of this type of system requires an intermediate level of technology knowledge.

Novelty - Choose tools that excite the student and encourage investment in distance education.

Speed - Choose technology that offers easy and quick access to course materials and can be used several semesters, thereby minimizing the cost of reworking each time.

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Buy-in to Online Courses: Reflections from E-learners' Journal Papers

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Abstract: This paper is a qualitative study of graduate students' experiences as e-learners as reflected in papers based on their journals. The two research questions were: What do students experience as they take an online course? and How do students express their buy-in or lack of buy-in to an online course? Students' initial concerns about their transition to this new environment were related to learning strategies and inexperience with technology. They described their personal growth in adjusting to the online learning environment, and they personalized their journal papers with their unique writing styles, including metaphors and analogies. In general, buy-in or lack of buy-in to the online course was not necessarily dependent on students' entering levels of technological experience but seemed to reflect the students' initial mindset or a mindset change that occurred during the course. Guidelines for e-learning are offered.

New E-learners

Higher education worldwide is using the Web for delivering online courses and programs, with the result that e-learning enrollments are rapidly increasing as more courses are converted to this environment. Online courses allow e-learners greater flexibility in balancing their work, school, home, and social schedules. Such courses require students to have an expanded set of course prerequisites and requirements. No longer is content knowledge the only prerequisite; students must also possess the ability to function effectively and efficiently in an online environment (Hillman, Willis, & Gunawardena, 1994).

Although students flock to online courses in an attempt to gain course credit without having to sit in a classroom, they experience difficulties adapting to this innovative approach. Rogers (1995) defines an innovation as an idea, practice, or object that an individual perceives as new. Students must adapt to multiple elements in their first online class—getting an Internet Service Provider, configuring the computer, using the software required, accessing the course web site, and participating in the online classroom (Eastmond, 1995; Palloff & Pratt, 1999).

E-learners face a complex, multi-faceted scenario that they must approach in a "mindful" (Langer, 1989) manner. The transition from the traditional to the online classroom can be difficult if students approach this new environment in a "mindless" manner by assuming the experience will be the same as the traditional classroom. Because students believe they know how to function in a classroom, their premature cognitive commitment, or mindset, can actually work against their successful transition to e-learning. Harasim (1989) pointed out that those who approach this new domain from old mindsets may apply incorrect metaphors to the online environment, such as assuming that e-learning is easy. Hara and Kling (2000) described students' frustrations in an online course—lack of prompt feedback, ambiguous instructions on the Web, and technical problems. Researchers have identified skills needed for transition to the online classroom: a new vocabulary; new or

revised learning practices; technology training; and patience with the instructor, the coursework, the delivery system, and the computer (Eastmond, 1995; Gibson, 1998). Palloff and Pratt (1999) asserted that student "buy-in" (p. 19) is essential for a successful online class.

Frustration with the above factors can cause students to become disenchanted with the online classroom. Students with learning-how-to-learn skills reach into their "bag of tricks" (Eastmond, 1995, p. 100), either choosing strategies that have worked previously or adapting a known strategy. Eastmond suggested that students learn about the online classroom in two ways: (a) being in the environment; and (b) becoming part of the online community by sharing ideas, troubleshooting problems, and finding solutions to the questions that inevitably plague students.

Yet the research literature on the use of Web is short of analytical studies as well as qualitative studies. Burge (1994) asserted that most of the literature on computer-mediated communication in higher education is "cautious optimism to hyperbole" (p. 22). The field has not critically addressed negative implications, especially from students' perspectives. Brace-Govan and Clulow (2000) contended that although a large body of literature addresses the issues of teaching online, little research investigates students' concerns about learning online. Hara and Kling (2000) charged that researchers must examine the actual experiences of students in online courses instead of reporting only on the positive aspects.

E-learners' Journals

Having students keep journals encourages them to reflect on their experiences and ideas and also fosters development of student-teacher discourse. Student journals have been used to encourage e-learners' reflections in the areas of political science (Hammer, 1997), nursing (Naidu & Oliver, 1999), anthropology (McKee, 1999), adult learning (Gibson, 2000), and business (Brace-Govan & Clulow, 2000). Although the method of obtaining information was similar in each case, the purposes and findings differed. For instance, Hammer illustrated how online technologies can be extended to the traditional journal assignment by "creating a space in which the student and teacher more closely enter into a discourse" (p. 70). Naidu and Oliver designed a problem-based learning assignment in an online course for nursing students to reflect on critical incidents and then gave "informative and corrective feedback concerning [the] use" of reflection (p. 333). As a result, the nursing students were able to describe what happened and assess their own actions while adopting more structured and systematic approaches to problem solving. McKee reported that journal assignments can "offer the opportunity to engage in a non-threatening extended conversation with the instructor" (p. 70). Gibson portrayed adult learners' "perspective transformation" (Mezirow, 1991) in an online class as the "ultimate disorienting dilemma," a view derived from analyzing student papers of reflections on their e-learning experiences. To organize and analyze the students' comments, Gibson used Mezirow's 10 steps of perspective transformation, which begins with a disorienting dilemma. Brace-Govan & Clulow's study of undergraduate business students' journals of their perceptions of the learning experience found that students needed information about how to interact online and favored an induction exercise at the beginning.

This paper reports on a qualitative investigation of the distance learning journal papers of graduate students' experiences of learning in an online course. The following research questions framed the study:

- What do learners experience as they take an online course?
- How do learners express their buy-in or lack of buy-in to an online course?

Methodology

Qualitative inquiry focuses on meaning in context and requires the researcher to look for underlying meaning while gathering and analyzing the data (Merriam, 1998). The online course was for graduate students enrolled in a 15-week course at a large southwestern university in the United States. The 18 participants were 12 female students and 6 male students with a range of telecommunications experience: 6 novice computer conference users, 7 intermediate users, and 5 experienced users.

"Foundations of Distance Learning" was a graduate course focusing on applications of effective instructional methodologies to educational settings via distance education. Students examined the foundations

of distance learning from a theoretical perspective while practicing distance learning. The students met face-to-face one full day at the beginning of the semester for the course and syllabus overviews, technology training, and getting to know one another. All other sessions took place via the Web to obtain course information, and FirstClass computer conference software to post coursework and communicate with classmates and the instructor. Students used asynchronous computer conferences, synchronous chats, and shared workspaces for their work.

One course requirement was to keep a journal and write a reflective paper on learning at a distance. In their journals, students described their recent distance learning activities and reflected on their growth based on comments made in previous entries, and the instructor inserted her comments periodically. They wrote in FirstClass collaborative document writing spaces, which were open to their classmates. Approximately halfway through the semester, they wrote short papers about their distance learner experiences and described their process of learning at a distance.

The data sources were the students' distance learning papers. The data collection consisted of downloading and printing the papers that had been posted in FirstClass. To analyze the data, we used the constant comparative method (Bogdan & Biklen, 1992) to categorize the data according to the two research questions. We reported on the data using the participants' words corrected only for comprehensibility.

Results

E-learners' Course Experiences

What do learners experience as they take an online course? The students' reflections of their online learning experiences in their distance learning papers disclosed the difficulties they encountered in the online course and their feelings about attempts to overcome the difficulties.

Students' reflections revealed difficulties in learning to use technology and functioning effectively online. Students unfamiliar with FirstClass found it difficult to use initially. Not having regular class meetings to help them organize their time efficiently was another difficulty. A student with no previous distance learning experience and limited technology skills wrote that his initiation as an e-learner would have been enhanced had he "received prior exposure to the mechanics of online interaction in a classroom environment utilizing distance learning only in a supplemental capacity." He explained, "Students who have experience with distance learning enjoy a considerable advantage in knowledge of both subject and self. I began this course with only the barest of knowledge about distance learning and even less knowledge of how much mental and organizational effort a distance learning class requires." Even students with distance learning experience and skills acknowledged difficulties: "Personally, I do find learning at a distance challenging.... I find that even those of us that are the most organized and disciplined experience difficulty with keeping on track. I still fall behind in some areas, misplacing calendars and forgetting what day it is."

In describing their strategies to overcome the difficulties, students expressed isolation, frustration, and stress due to juggling many responsibilities. They commented that it took a great deal of time to adjust to the online environment, although they tended to remain hopeful as they established their own learning strategies. "I hope the 'just do it' response strategy I devised for remedying my performance shortcomings will work," reported the student with limited distance learning experience and skills. One student relied on her intuition: "Just as the experience got started, I found myself calming down and working on the assignments in an orderly fashion. Personal instincts of organization begin to kick in and I find myself scheduling tasks."

Expressions of Buy-in or Lack of Buy-in

How do learners express their buy-in or lack of buy-in to an online course? In their distance learning papers, the students expressed their buy-in or lack of buy-in to an online course in two ways. Students recognized and described their personal growth in adjusting to the online learning environment. They also personalized their papers with unique writing styles, which included metaphors and analogies.

Some students attributed their gains in adapting to the online environment to the journal and paper assignments, which required reflection on the process. The student who entered the course with minimal background and skills described his buy-in to the online course with these words:

> I feel I have gained valuable insight into why my previous attempts at success have proved unsuccessful. In implementing certain changes to my study habits and contribution efforts, I will gain, by semester's end, a much clearer picture of my true prospects for success in utilizing distance learning technology.

A student with more advanced telecommunications skills portrayed her growth towards buy-in as a reflection on the cyclical nature of the online course: "The ups and downs of the cycle include satisfaction of completing a task and the depressions of falling behind for one reason or another. In the end, however, I do know in my heart that the actual completion of the course will break the cycle and leave the experience on a high note."

The papers contained numerous metacognitive reflections indicating buy-in to the online experience. One student reported, "The knowledge and experiences I have had in distance education have greatly inspired me to go further to pursue my research interests—web-based instruction." The students acknowledged that they gained new forms of valuable information, including the course content, the online environment and specifically FirstClass; and new information about themselves and their ability to transition to a new environment.

The other way the students expressed buy-in or lack of buy-in to online courses was by personalizing their journal papers with graphic analogies and metaphors, and several used direct quotations from their own and others' distance learning journals. Lack of buy-in to online learning was indicated in the following metaphors: "a mental, intellectual, and creative death-trap," a "learning experience [that] bordered on the metaphorical equivalent of first learning how to drive on a racetrack during a Grand Prix," and "walking into a university library without a directory; sometimes I feel like I am lost!!" Some students were ambivalent about the online experience, as indicated in these metaphors: "It is not the Garden of Eden described by its boosters, but neither is it the barren wasteland of my worst fears" and "It is both lonely and full of camaraderie. It is dull and exciting. It is everything and nothing. It is a paradox.... [In times of frustration] I exist in a dark cocoon of technology that has no way out." Descriptions indicating buy-in included the following metaphors: "Meeting learner needs is like meeting with customized product versus mass product" and "interactions have kept me from feeling like a widget on an assembly line."

Conclusions

Students may perceive the online classroom to be the same as the face-to-face classroom initially, but they soon discover that taking an online class is vastly different. Although the students in this study reflected on their experiences in a variety of ways, many of their papers yielded similar ideas about coping mechanisms and learning strategies. Rogers (1995) suggested that the process of adopting or rejecting an innovation is an information-seeking and information-processing activity that occurs as an individual obtains information about an innovation, in an attempt to decrease the uncertainty that surrounds it. Many students acknowledged the need to "settle in" by allowing themselves to feel overwhelmed at the beginning of the course. Several studies reported discoveries about students' frustration with technology and instructor's lack of experience (Hara & Kling, 2000) and the need to ensure that students can function effectively and efficiently online at the beginning of the course (Harasim, 1989; Hillman et al., 1994; Palloff & Pratt, 1999).

Buy-in or lack of buy-in to this online course was not necessarily dependent on students' entering levels of experience with technology or content, as those with limited previous experience often expressed commitment to e-learning later. Instead, students' buy-in or lack of buy-in seemed to reflect either the initial mindsets or a mindset change (Telg, 1995) that evolved during the course. Those who began the course with negative mindsets about e-learning ended the course with negative, grudging acceptance, idealistic acceptance, or positive mindsets. Those who began the course with positive mindsets ended the course with either positive or qualified positive mindsets about e-learning.

The online journals created a space where students were encouraged to reflect and a student-teacher discourse was allowed to develop. Several students commented on the sense of continuity of their journals as a collaborative document, in which they merely added their newer reflections at the top of the existing text. This

practice allowed "the participants to see their comments as part of a continuing discourse" (Hammer, 1997, p. 70). The process of keeping a reflective journal and reading their classmates' journals helped several students gain self-assurance. Gibson (2000) acknowledged that in a similar assignment requiring student reflections on the experience of learning at a distance, she hadn't assigned the responsibility of asking them how they as learners could enhance the teaching/learning transaction for everyone. She also wondered if the assignment needed more structure. In other words, would introducing concepts of disorienting dilemma and perspective transformation lead to the latter stages of Mezirow's (1991) perspective transformation: provisional trying of new roles, building competence and self-confidence in these new roles, and reintegration of one's life? Similarly, we wonder if we should redesign the journal assignments to include initial information about difficulties of online learning or to structure the students' reflections more directly by having them reflect on a critical incident and identify specific learning that may have occurred as a result, as Naidu and Oliver (1999) did with nursing students.

McVay (2000) reported on research that learning is a cyclical process that involves reflecting, connecting, deciding, and doing. Students often need to be guided into metacognitive thinking and reflective learning: "Students need to find ways to tap into this cycle—to create not only time to think and notice feelings, but time for questioning assumptions and brainstorming solutions" (p. 21). McVay recommends that students practice reflective learning by writing associations and feelings in two columns labeled "What I liked" and "What I didn't like," which would lead to a third column "What I will do" for decisions about future action (p. 22).

An outcome of this research was the development of guidelines for e-learners to use reflection to ease their adjustment and foster buy-in to the online course. The guidelines are categorized according to the general times during the semester: at the beginning, during, and at the end of the semester.

Guidelines for E-learners

Before the semester begins

- prepare for inevitable technology problems
- accept that an online course is different from a traditional course and likely to be completely different from what you expect
- accept that you may experience new feelings, frustrations, highs and lows, and confusion
- plan how you will change the way you communicate with your classmates and instructor
- accept that change is hard work
- accept that any time you encounter a change situation, it will probably take you longer initially to complete tasks
- be patient with yourself and others
- accept that you, your instructor, and your classmates are not on 24-hour call
- become comfortable with the reflection process

During the semester

- continue to practice patience and make new discoveries
- share methods and tips for collaborating and for using the software
- get to know your "learning" or "student" self—examine how you learn, read, study, approach tasks, organize yourself, etc.
- continue to be self-observant. Reflect on what happened—what did you do? did it work? did it fail? why? why not? were there critical incidents?
- continue to discover—what new information or skills have you learned? how has it helped you?
- learn to interpret what your discoveries mean for you—will you be different? in what ways? will you act differently next time?
- push yourself to be self-observant of your own thinking, feelings, and actions. We all like to "people watch." We need to become adept as "self-watchers"

End of the semester

- evaluate yourself—how have you changed? what did you learn? what will you do differently next time?
- evaluate the class in terms of how it worked for you—likes/dislikes? what worked/didn't work? what will you do differently next time?

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Characteristics and Affordances of Adaptive Hyperbooks

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Abstract: We explore the design issues of adaptive hyperbooks in relation to how using hypermedia technology change the nature of the traditional book. To address some of these issues we have developed and tested MetaLinks, an authoring tool and web server for adaptive hyperbooks. The system is designed to: 1) support inquiry, exploratory, or curiosity-driven learning in richly interconnected material; 2) support the construction and conceptualization of content through three "epistemic" forms: narrative, network, and hierarchy, and 3) ameliorate a number of usability issues: disorientation, cognitive overload, poor narrative flow, and poor conceptual flow. These goals are achieved through a number of interface and adaptive features, including "narrative smoothing," "custom depth control," and "thematic links."

Introduction

Innovations in digital media and hypermedia have extended the possibilities inherent to our notion of and use of the book. For our purposes "hyperbooks" are similar to traditional text books but modified and extended according to the affordances of the web and hypermedia (Conclin 1987).[1] *Adaptive* hypermedia documents are composed "on the fly" so that the content, style, and/or sequencing of the page is customized to the needs of the particular learner and situation (Brusilovsky 1998; Brusilovsky et al.1996). The key differences between traditional book and hyperbooks are the decomposition of the material into modular pages, the inclusion of hyperlinks, and the addition of interactive tools such as search engines.[2] For adaptive hyperbooks there is the additional difference of adaptive content and adaptive navigation support. In a transition from traditional books to hyperbooks, we must reinterpret the form and function of the page as the page moves to the computer screen. The flow of experience of reading is transformed as it includes navigating. Our understanding of a book's content is altered when digital books can be composed or adapted dynamically for each use. The changes are significant from both the author's and reader's (user's) perspective. Hypermedia books (hyperbooks) have existed for decades but we are still getting accustomed to using them and have yet to established norms for their forms, functions, and limitations. To address some of these issues we have developed and tested MetaLinks, an authoring tool and web server for adaptive hyperbooks. Below we will describe MetaLinks and discuss a number of key issues in the transition from traditional books to hyperbooks. Along side these general hyperbook issues we will describe the particular approach that we took with the MetaLinks project.

The MetaLinks User Interface

Figure 1 shows a typical MetaLinks hyperbook screen. From top to bottom, it contains the navigation bar, the page title, the page text, "custom depth control" navigation buttons, and a list of links to children pages. The author can include as many figures as desired, and specify a scaling factor for each picture. In addition to the main content window shown in the figure, there are separate windows for a table of contents, a search tool, a glossary, and an annotated history tool. Green colored underlined words correspond to words in the glossary. When the user mouses over these words the definition pops up ("stretch text") as shown in the figure. Teal colored underlined words indicate footnotes, which also pop up as stretch text. When the user clicks on the "Related Information" tab, they see a list of links to related pages, as shown in the insert to the right of the figure.

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[1] Though we are dealing with hyperbooks on the web, many educational CD-ROMs and web sites are hyperbooks under our definition.

[2] We acknowledge that in moving from paper to screen many affordances are lost. And, though our intent is not to proclaim the benefits of electronic books over traditional books, we do not discuss the relative advantages of paper books in this paper.

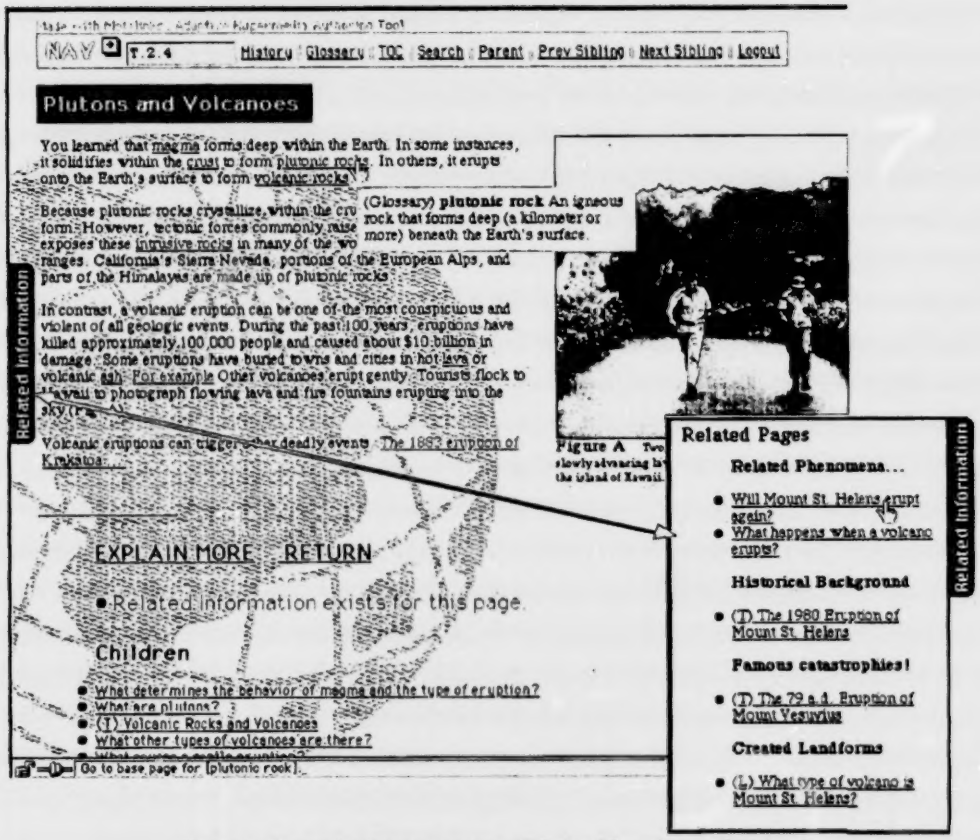
NAV T.2.4 History Glossary TOC Search Parent Prev Sibling Next Sibling Logout
Plutons and Volcanoes
You learned that magma forms deep within the Earth. In some instances, it solidifies within the crust to form plutonic rocks. In others, it erupts onto the Earth's surface to form volcanic rocks.
Because plutonic rocks crystallize within the cru
form. However, tectonic forces commonly raise
exposes these intrusive rocks in many of the wo
ranges. California's Sierra Nevada, portions of the European Alps, and
parts of the Himalayas are made up of plutonic rocks.
(Glossary) plutonic rock An igneous rock that forms deep (a kilometer or more) beneath the Earth's surface.
In contrast, a volcanic eruption can be one of the most conspicuous and violent of all geologic events. During the past 100 years, eruptions have killed approximately 100,000 people and caused about $10 billion in damage. Some eruptions have buried towns and cities in hot lava or volcanic ash. For example Other volcanoes erupt gently. Tourists flock to
Volcanic eruptions can trigger other deadly events. The 1883 eruption of Krakatau
Related Information
EXPLAIN MORE RETURN
Related information exists for this page.
Children
What determines the behavior of magma and the type of eruption?
What are plutons?
(T) Volcanic Rocks and Volcanoes
What other types of volcanoes are there?
Go to base page for [plutonic rock].
Related Pages
Related Phenomena...
Will Mount St. Helens erupt again?
What happens when a volcano erupts?
Historical Background
(T) The 1980 Eruption of Mount St. Helens
Famous catastrophies!
(T) The 79 a.d. Eruption of Mount Vesuvius
Created Landforms
(L) What type of volcano is Mount St. Helens?
Related Information

Figure 1: Tectonica Interactive page T.2.4, with a picture showing two geologists running from a lava flow.

To date, MetaLinks has been used to author four hyperbooks (see http://ddc.hampshire.edu/metalinks/). The largest is the introductory geology hyperbook Tectonica Interactive with approximately 400 pages, 500 graphics and 320 glossary entries. The second MetaLinks hyperbook authored was the MetaLinks Users Guide. The remaining two hyperbooks were created as part of a Hampshire College service learning class. College students in the class used MetaLinks to build hyperbooks in collaboration with two community based organizations. The first was "Famous Women Mathematicians" which was built in collaboration with Amherst Middle School teachers, for use by an eight grade class. The second was "Early 20th Century Children's Games," a hyperbook built in collaboration with a group of senior citizens enrolled in a computer literacy class in Holyoke Massachusetts. The project became somewhat of an oral history project, as seniors told us their memories of the games they played as children, and we organized this material thematically for the hyperbook. Both of these college-class-built hyperbooks are on the order of 30-50 pages large.

We conducted two formative evaluations of Tectonica, which are the focus of (Murray et al 2000) and (Murray et al. 2001), one with 20 subjects, the other with 24. The empirical evidence from both trials indicates that the current set of features, which leave the locus of control and intelligence solidly with the student, in general avoid all of these potential problem issues of disorientation, cognitive overload, discontinuous flow (poor narrative flow or poor conceptual flow), and content non-readiness. Overall satisfaction and perceived learning effectiveness were high, as subjects responded positively to questions regarding usability and usefulness. For example, in the first study 90% said they would prefer using the hyperbook to a text book. No individual feature stood out as being confusing. We also noted that there was a wide range of navigation styles and tool use among subjects. Subjects indicated that they explored topics unrelated to their initial question, and

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that the software facilitated exploring according to curiosity or interest (but there was only suggestive evidence for attributing this to specific features).

Hyperbook Design Issues and MetaLinks Solutions

A number of benefits of hyperbooks have been proposed. Hyperbooks can contain alternative structures, content, and navigation paths that emphasize different goals, skill levels, or perspectives (Conclin 1987; Ferguson et al. 1992; Spiro & Jeng 1990)). Learners have the ability to navigate through the content in ways that match their goals, interests, and learning styles. The learning experience can be more learner-centered and interactive, as learners actively create their learning trajectories in ways not easily done with traditional books.[3] How do hyperbooks compare to other forms of educational software? Hyperbooks *could* contain features such as interactive exercises, simulations, user scoring, and coaching found in other types of educational systems, but these are peripheral to the essential nature of the hyperbook. Though interactivity and feedback are important aspects of educational software, our discussion is concerned with the reading, searching, and browsing activities that take place while learning with hyperbooks. While reading and browsing are mundane activities compared to the possibilities inherent to computer-based learning environments, there are important research issues related to these limited activities. Below we discuss a series of issues that are inevitably encountered in moving from traditional books to hyperbooks (and adaptive hyperbooks). Along side these general issues we will describe the features in MetaLinks that address the issue.

Modularity of pages. The experience of reading and navigating among hyperbook pages (or web pages) can be quite unlike that of flipping through the pages of a text book. Unlike textbooks, in which page breaks are of little significance and topics are organized around sections, the pages in hyperbooks are relatively modular content units. Some hypermedia documents have long pages with lots of content that must be scrolled down, but such pages can not be used as flexibly. Traditionally, hypermedia is defined as being composed of "nodes" (called pages in our case) and navigable "links" between these nodes(Conclin 1987). The pages are not completely independent, but usability concerns compel us to organize the material into small grain-sized thematic units to allow for non-linear navigation, multiple perspectives, and multiple uses. That is, a modular page that covers one or a small number of tightly related topics is more able to function as a component in multiple reading trajectories with different purposes.

MetaLinks approach: In MetaLinks books we conform closely to the modularity criterion. Also in most hypermedia a link goes from a particular phrase (the underlined text) to another page (or location within a page). MetaLinks hyperbooks links go from *page* to page. We see the page as a thematic unit, and the "related links" (described later) are semantic relationships between these units.

Limiting how much content is on the page. It is best to limit the amount of text on each hyperbook page. This is in part due to the modularity criterion, and also because commonly accepted hypermedia usability guidelines recommend a limited amount of text on each page (in part because reading computer screens involves more eye strain). Users also expect a greater proportion of pictures to text in hypermedia vs. traditional text books.

MetaLinks approach: Our policy for nominal page size is not precise, but supports the goal of being able to navigate to a particular page (as opposed to navigation to somewhere *within* a page) to learn about a particular topic. In general we aim for pages being two to four paragraphs long. Non-essential text and graphics such as examples and footnotes can be hidden inside "stretch text," as shown in the figure. Stretch text allows the screen to be less cluttered while still giving the user easy access to additional information.

Rhetorical and hierarchical structure. Some hypermedia documents have a completely open network-like structure. But for hyper*books* it is best to maintain the hierarchy (as reified by the table of contents) as the primary organizational structure (for reasons described below under "epistemic forms"). Text books are constrained by convention to having consistency in the size and depth of each chapter or section, but with the advent of electronic books we are no longer subject to these constraints. The author may decide to expand one particular section into what might be considered an entire "book" in the traditional sense. The user reading any page (or at any level of generality) need not know how "deep" the book goes with that topic. Also, the author who wants to leave open the option of expanding sections in the future can write the text of a page in such a way that it does not presuppose the depth of content below the page.

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[3] It must be noted that empirical studies do not uniformly support all of these proposed benefits, and there is still uncertainly in the research community regarding exactly what types of learner, content, and task characteristics are best suited for hypermedia formats.

MetaLinks approach: Most books are structured around a chapter/section/subsection decomposition model. In MetaLinks hyperbooks the parent/child relationship is used to create a hierarchical decomposition, but we don't call parts chapters or sections because the hierarchy can go arbitrarily deep, and different users may have "top level" entry points that vary in how deep they are in the hyperbook.[4] The hierarchical structure of the book is reified in the annotated table of contents (TOC) tool. The rhetorical structure of most books includes transitional elements that introduce, conclude, or relate sections. In MetaLinks hyperbooks a parent page is considered a summary, overview, or introduction to all of its children pages (unless the page has no children). Think of everything in the family tree "below" a page as containing further details or elaborations of that page. After reading a page, the user decides whether they want more depth on that topic or want to continue reading at the same depth (see "horizontal reading" and "custom depth control" below). If they navigate to more depth, eventually they will "pop back up" to the original page (to maintain a sense of orientation they are given a visual indication that they have returned to a page where they branched off). According to this temporal flow of events, the original page becomes both an introduction and a conclusion for its children. Thus, the author is encouraged to compose a page so that it works as both a summary and a refresher to its children's contents.

Supporting thematic relationships among content. As mentioned, the primary organizational structure for hyperbooks is the hierarchy. However, hierarchies do not capture the conceptual richness of most domains. Each topic is related to others in numerous ways. There are multiple perspectives on the material, suggesting multiple learning paths. Hyperlinks in hypermedia support this more associative and flexible aspect.

MetaLinks approach: MetaLinks includes **thematic links** (non-hierarchical, associative, or "tangential" links) called Related Links in addition to the hierarchical child and parent links between pages. Each page has a set of Related Links to other pages, accessed via a pop-out menu by clicking on the "Related Information" tab in Figure 1. Unlike most other hypermedia, the links are "typed" or categorized to indicate the type of relationship they represent. The authoring tool provides a list of possible link types, but the author can create her own types for each hyperbook. They allow the learner to maintain a path through the material that responds to their curiosity and inquiry goals. Here are some of the approximately 20 link types we used in the geology domain: "Where in the world?" "Are scientists sure?" "Extreme cases and famous catastrophes." "Geologists used to think..." "How is it measured?" "What do I need to know first?" Authors can use the link types to organize their content creation. Thematic links encourage the learner to assimilate domain knowledge structures that reflect the relationships and themes important to the author/expert. Link types can also act as author prompts that remind or inspire the creation of related content or the creation of more links among existing content.

Hypermedia side effects. The distinguishing characteristic of hypermedia, i.e. the ability to navigate (or "jump") easily from one location to another, in addition to being responsible for its benefits, leads unavoidably to a set of problems: disorientation, cognitive overload, poor narrative flow, and poor conceptual flow (Luckin et al. 1998). These problems can also be seen as a result of the tension between the linear/narrative and non-linear/associative natures of hyperbooks. **Disorientation** refers to users not knowing where they are, where they have been, or how to get to where they want to go in hypermedia space (the "lost in hyperspace" problem). **Cognitive overload** refers to users being overwhelmed or confused by the options available to them in multi-path, multi-tool environments such as hyperbooks. **Narrative flow** refers to the didactic or rhetorical flow of the text itself. **Conceptual flow** refers to the flow of ideas or concepts.[5] Good conceptual flow includes "content readiness," which is the traditional intelligent tutoring systems goal of tailoring content so that the learner is neither bored because it is too easy, nor overwhelmed because it is too difficult (i.e. remaining within the learner's "zone of proximal development").

MetaLinks approach. Our goal is to support learners' exploration of hypermedia spaces while avoiding or ameliorating these four classic problems. Below we describe our approach to each of these issues.

Dealing with disorientation. Hypermedia users need navigation support from both local and global perspectives. Globally, they need to be able to see "the big picture" of the book and be able to know where the current page is in relation to this big picture. Locally, they need to be able to navigate to and have information about pages that are adjacent to or near the current page. Also, users need support with the temporal form of disorientation, i.e. "where have I been?"

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[4] A family tree metaphor (parent/children/sibling) is used for hierarchical relationships among pages in MetaLinks.

[5] To clarify the difference, one could imagine a text with a good conceptual flow which was poorly written and choppy, thus having poor narrative flow. Similarly one could imagine text that seemed to read very smoothly but did not make rational sense, or in which prerequisite concepts were not introduced sufficiently for understanding the text, and thus the text has poor conceptual flow.

MetaLinks approach: MetaLinks has a number of features, including the table of contents and navigation bar, that support global and local orientation. The annotated history tool gives the user a picture of where they have been, and importantly, shows *why* they went to each page (via search, a particular thematic link, etc.). It helps the user see the structure of their navigation path, where they took tangents, etc.

Dealing with poor narrative flow. As mentioned, the user's expectations for smooth narrative flow can be thwarted as they jump from page to page in hypermedia.

MetaLinks approach: In MetaLinks hyperbooks the default narrative flow (a linear navigation path for which the reading or organization of the content is most natural or perspicuous) differs from text books and most other hyperbooks -- it is breadth-first rather than depth-first, and organized for "**horizontal reading**." The default "next" page is the sibling page. Thus the default is to continue reading at the same level of generality. The children of any page cover the material at greater depth. In transforming a traditional text to the Tectonica hyperbook, we had to rewrite the text to conform to horizontal reading. We have a simple but elegant partial solution to the narrative flow problem, which we call "**narrative smoothing**.". Each page has associated with it an "intro text" paragraph. This paragraph eases the reader into the subject of the page, giving a little background or introduction. If the user jumps to that page in a non-standard way, i.e. one that does not follow horizontal reading, the intro-text is pre-pended to the main text of the page.

Dealing with poor conceptual flow. Hyperlink jumps can also cause problems with the flow of ideas and the expectation that prerequisite information will come first.

MetaLinks approach: The glossary stretch-text partially addresses the conceptual flow issue. If a learner does not understand a term they can easily see its definition. However, the terse definitions that pop up may not be enough. If the user *clicks* on a glossary term they navigate to its "base page," which is the page in the hyperbook that best explains that concept. From a base page the user can navigate down to additional detail if needed. Also, the author can create related links of the type "prerequisite concepts" for better content readiness.

Dealing with Cognitive Overload. There will always be tradeoffs involved between the desire for an easy to use hypermedia system and a full-featured hypermedia system. However, with good interface design it is possible to have a usable and full-featured system.

MetaLinks approach: Feedback from users has informed MetaLinks' interface design. Cognitive overload from the variety of navigation features has not been seen as a problem in recent formative trials. Stretch text can be used to limit the amount of text on the page, further reducing cognitive load. In addition, horizontal reading sets the stage for an innovation called "**custom depth control**" which further addresses the problem of cognitive overload. In MetaLinks the Next and Back buttons in traditional hyperbooks are replaced with Explain More and Next buttons. "Next" goes to the next page which continues at the same level of generality (horizontal reading). "Explain More" begins a path across the children of the current page. When the last child in a sibling sequence is reached the Next button becomes a Return button, and the user is returned to the parent page where they originally pressed the Explain More button. Thus, the user has continuous control over the level of depth at which they are reading.

Supporting exploratory navigation. The network and hierarchical natures of hyperbooks facilitate more research-like and open ended uses. Hypermedia supports behavior called inquiry-based, discovery, or exploratory. Exploratory navigation is appropriate for open-ended questions and/or learning in ill-structured domains in which the richness of the content suggests multiple themes, perspectives, or learning paths (Woods 1975). Most hyperbooks contain glossaries, bibliographies and/or indexes that are tightly integrated with the text. I.E. the user can easily navigate among the referents involved. Search engines also support the research-like uses and reference-like aspects of hyperbooks.

MetaLinks approach: MetaLinks has integrated glossary and search tools. It facilitates exploratory and inquiry navigation behavior in several other ways. First, the related links feature facilitates exploring related but tangential topics. Second, custom depth allows the user to read the material at their chosen depth level, and easily explore any topic more deeply. Third, "inquisitory page titles" (see Figure 1) express page relationships in terms of questions to support an inquisitory "Q&A" navigation style (Ferguson et al. 1992)). Finally, to the degree that the design of the child links, search, and TOC features alleviate the four navigation "side effects," the software supports the user in branching out from the default navigation path and maintaining orientation and flow.[6]

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[6] It should be noted that MetaLinks does not explicitly or directly support the full set of skills addressed in educational software that supports "scientific inquiry skills" but supports a more informal notion of inquiry.

Conclusions

MetaLinks is designed with three primary goals. The first is to support inquiry, exploratory, or curiosity-driven learning (all meaning more or less the same thing) in richly interconnected content. The second, related goal, is to support the construction and conceptualization of content through three "epistemic" forms: narrative, network, and hierarchy. The third goal is to ameliorate a number of usability issues: disorientation, cognitive overload, poor narrative flow, and poor conceptual flow, that inevitably arise with hypermedia documents. MetaLinks includes variations of features found in other adaptive hypermedia systems. We have given more detailed descriptions of those features that are relatively unique or innovative, including narrative smoothing, custom depth control, and thematic links. In other papers we discuss evaluation trials, the specifics of the adaptive features, and compare this work with other hypermedia and adaptive hypermedia projects. In this paper we compared the authoring and use of hyperbooks with traditional books, outlined a series of ubiquitous issues in hypermedia and hyperbooks, and described the MetaLinks approach to the these issues.

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Raising Student Social Presence In Online Classes

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Abstract: Distance and online education is increasing in importance in the offerings of many universities. As this occurs, instructors are developing ways to use new media to support traditional teaching practices. This is an important effort as online education is still viewed with a degree of skepticism by some. By successfully transferring accepted teaching practice into online education, instructors are helping to demonstrate that online education can be of high quality. Some instructors are also developing different teaching practices to take advantage of the new media. This too is important because the technologies of online education may support learning strategies that are not feasible in traditional teaching modes. A subject of importance in both efforts is that of student social presence. Social presence, or the perceived saliency of members of the online group, may be important to the satisfaction of students in online classes. This paper explores issues relating to social presence in online classes and suggests ways to increase student social presence in online classes.

Online Education

There are few topics that span across departments and through the range of academia with more recognition than that of online education. In fact online education is becoming a topic that is reaching beyond the halls of academe and into the corporate world. John Chambers, CEO of Cisco Systems says, "The next big killer application for the Internet is going to be education. Education over the Internet is going to be so big it is going to make e-mail usage look like a rounding error" (MacDonald, 2000). The fact that the corporate world is beginning to take notice of the potential earnings power of online education does not escape the attention of administrators in higher education. In some cases this may be causing a weakening in the resistance to online education that was not too uncommon not that long ago. Too, private providers of online education like the University of Phoenix are greatly expanding their online presence. And this interest in providing online education also includes well-established and venerable institutions including Harvard, Yale and others (Carr, 2000).

The increase in the offering of distance education is a trend that has been documented by the National Center for Education Statistics which in a December 1999 report entitled "Distance Education at Postsecondary Education Institutions: 1997-98" reports, "... distance education appears to have become a common feature of many postsecondary education institutions and that, by their own accounts, it will become only more common in the future" (Lewis, Snow, Farris, Levin, and Green, 1999. p. vi). The same report indicates that public two-year and four-year institutions are the most likely to offer distance education (Lewis et al. p. 15) with 78% of public four-year institutions and 62% of public two-year institution reporting that they offer some distance education opportunities (Lewis et al. p. iii). The trend seems to be clear, with the number of distance education course offerings and enrollments approximately doubling from the levels reported in 1994-95 (Lewis et al. p. vi). While the distinction between distance education and online education is sometimes difficult to extract, this report states, "The percentage of institutions using asynchronous Internet-based technologies, however, nearly tripled, from 22 percent of institutions in 1995 to 60 percent of institutions in 1997-98" (Lewis et al. p. vi). Clearly distance education is becoming online education and online education is being offered by more and more institutions.

With the question; "should we adopt online education?" having been answered in the affirmative, the question has become; "How should we implement online education?" This issue has been examined by many, for example the University of Illinois Faculty Seminar released a report entitled "Teaching at an Internet Distance: the Pedagogy of

Online Teaching and Learning" which says, "...online teaching and learning can be done with high quality if new approaches are employed which compensate for the limitations of technology, and if professors make the effort to create and maintain the human touch of attentiveness to their students" ("Teaching at an Internet Distance," 1999). Another important consideration in the question of how to do online education is, to what degree traditional teaching methods can be used, or adapted to work online? There is a compelling reason for this. Those who have taught for a period of time develop a set of practices that work for them. Through use, these practices become comfortable and validated and most importantly are accepted by the academic community as appropriate and expected. As Meyen, et al. (1999) stated, "While the demand for Web-based instruction is high, many in academe are extremely cautious with regard to its pedagogical soundness." When developing online educational opportunities, faculty are sensitive to the fact that their work may elicit closer scrutiny than is typically the case in the traditional face-to-face teaching methods. In such situations, there is a strong desire to develop online resources that closely resemble the institutionally accepted practices."

This is to be expected in a period of time where there is a transition between instructional delivery systems. And while many do call for re-thinking the nature of the teaching-learning process in higher education, there is some truth in the old principle that good teaching is good teaching. There are many parts and components to a quality educational experience, whether that experience is online or not. These include aspects that can be attributed to the content provided by the instructor, the content provided by other sources such as texts, and aspects of the course attributed to the qualities of interactions or experiences in the class.

Aspects of content or information transmission fromthe traditional classroom that are easy to replicate in the online environment include instructor-created text-based hand outs, slide presentations, providing of readings, and use of text-based materials from various sources. Where online education has a problem replicating the traditional classroom are in aspects relating to interactions and classroom experiences. The use of technology-mediated communication changes the way these interactions can and do occur. Because of this, it is these types of interaction issues that are most interesting to examine. If an instructor wants to create an online class these problems must be addressed. What then is good practice, in terms of classroom interaction and how can good practice be taken online?

Looking at the much circulated, "Seven Principles for Good Practice in Undergraduate Education" by Chickering and Gamson (1987) we find guidelines for good practice that emphasize interactions in an educational setting. The seven principles are:

1. Good practice encourages student-faculty contact.
2. Good practice encourages cooperation among students.
3. Good practice encourages active learning.
4. Good practice gives prompt feedback.
5. Good practice emphasizes time on task.
6. Good practice communicates high expectations.
7. Good practice respects diverse talents and ways of learning.

These principles of good practice emphasize the creation of a learning environment that ensures high levels of interaction, cooperation, and communication. In many cases there is the perception that the technology used in online classes fails to adequately support person-to-person interaction. This is despite the fact that some researchers find that it is possible to develop personal relationships and communities via computer mediated communications (Chenault, 1998) and others, including Kraut, et al. (1998) find that "interpersonal communication is the dominant use of the Internet at home. If the Internet technology commonly used in people's homes is primarily used for interpersonal communication, why do students in online classes complain that they miss the interaction with their peers that they get in face-to-face classes? Are there things that can be done to better replicate the sense of being engaged in an educational experience with others? If there are, what are they?

Theories

Theories that seem appropriate for developing an understanding about what can be done to improve the person-to-person interactions in an online class are media richness (Trevino, Lengel, and Daft, 1987) and social presence (Short, Williams and Christie, 1976). Media richness is the ability of a medium to carry information. The

information transmission ability of a medium has at least two components, data carrying capacity and symbol carrying capacity (Sitkin, Sutcliffe, and Barrios-Choplin, 1992). In media richness theory, media technologies are rated or ranked according to their message carrying capacity. The criteria for rating media are based on the media's ability to: relay immediate feedback, transmit multiple cues such as body language, permit tailoring the message to the intended receiver, and relay communicator feelings or emotions (Daft and Lengel, 1984). Applying this rating system to technologies that are currently available for online education, the following matrix of media richness comparisons can be developed.

Media Rating (across) Criteria (down)	High	Medium	Low
Feedback	Face-to-Face Video Conferencing Synchronous Audio Text-Based Chat		E-mail Threaded Discussion Asynchronous Audio
Multiple cues	Face-to-Face	Video Conferencing	Synchronous Audio Asynchronous Audio Text-Based Chat E-mail Threaded Discussion
Message Tailoring	Face-to-Face	Video Conferencing Synchronous Audio E-mail	Text-Based Chat Asynchronous Audio Threaded Discussion
Emotions	Face-to-Face	Video Conferencing Synchronous Audio Asynchronous Audio	Text-Based Chat E-mail Threaded Discussion

Table 1: Relative richness of different media types according to four criteria.

Assigning the numerical value of 3 for high, 2, for medium and 1 for low, it is possible to rank the seven different media types into a hierarchy from richest to leanest.

	Feedback	Multiple cues	Message Tailoring	Emotions	Totals
Face to Face	3	3	3	3	12
Video Conferencing	3	2	2	2	9
Synchronous Audio	3	1	2	2	8
Text Based Chat	3	1	1	1	6
E-mail	1	1	2	1	5
Asynchronous Audio	1	1	1	2	5
Threaded Discussion	1	1	1	1	4

Table 2: Numerical values used to rank media types.

Which results in this ranking or hierarchy of communications media, richest to leanest.

Face-to-Face
Video Conferencing
Synchronous Audio
Text-Based Chat
E-mail / Asynchronous Audio
Threaded Discussion

Table 3: Hierarchy of media richness.

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Not surprisingly, synchronous technologies (Face-to-Face, Video Conferencing, Synchronous Audio, Text-Based Chat) tend to be rated richer than asynchronous technologies. This raises an important issue, which is, the desirability of creating asynchronous vs. synchronous online classes. One of the advantages of asynchronous online learning that, in the view of some, helps ameliorate the lack of face-to-face contact with teachers and fellow students is the ability to interact with the class according to a schedule convenient to each participant. Recognizing this, many online classes are largely asynchronous in nature. Fewer online classes are as rigidly synchronous as a traditionally taught class while many make use of both synchronous and asynchronous methodologies.

Whether synchronous or asynchronous, if media richness theory is accepted, one would expect to see students in classes using the richest media possible, experiencing the highest levels of social presence. Social presence as Short et al. (1976) describe it is the salience of a person in a mediated conversation. Rourke, Anderson and Garrison (1999) for their work in asynchronous text-based conferences define social presence, "...as the ability of learners to project themselves socially and affectively into a *community of inquiry*." Others have similar definitions with the basic meaning being that social presence is the degree that a person is perceived to be real in a mediated environment (Russo, 2000b). Russo has extended this definition of presence to explain that there are at least four types of presence in online classes. They are a student's perception of other students, a students' perception of the instructor, a student's perception of others' perception of them and an instructor's perceptions of a student (Russo, 2000a, 2000b).

In a recent presentation (2000b) Russo related that her findings indicate that social presence appears to have an impact on student satisfaction and learning. Factors that Russo finds have an impact on social presence and that should be considered are use of technologies that increase the probability of improving impressions of social presence and use of instructional practices which might lead to better establishment of social presence on the part of the teacher and students. Russo's work has also shown that because of the way her online class is structured and the technology that she employed in the development of the instructional components of her class, the social presence ratings of the instructor were much higher than those of the students (Russo, 2000a).

Examining Russo's use of technology as an instructional vehicle reveals that the instructor had two ways of projecting a presence into the class that students typically did not. First was the presentation of her voice in the form of audio lectures. Second was the use of her picture both as a design element in the web site and associated with her voice accompanying the audio lectures. Additionally, Russo's work indicates that students in the class did not use the threaded discussion feature of the class as an effective way to respond directly to each other. While Russo designed her online class to include student projects, Newberry (2000) found that the majority of groups used only e-mail to communicate about their projects. While e-mail has the potential for immediacy, in most cases its richness is no better than any text-based communications system. If an instructor wants to raise the social presence of his/her students, there must be ways beyond text-based e-mail to do so.

Practical Implications

Developers of online learning environments who are concerned with raising social presence of students are pursuing a number of strategies that can be emulated. These strategies can be conceptualized as impacting media selection, structure of activities, or individual communication practices. In each of these areas there are some specific recommendations that can be made that should help to ensure higher levels of interaction, cooperation, and communication among students. These strategies should be considered in the context of the difficulty or costs associated with them. The difficulty and/or cost of any strategy will depend on many institutional variables such as whether a particular media technology is available for use at the institution where the course is offered, if a modification in instructional practice fits within the time or technical development constraints of the class, or if effective ways of helping students learn communication strategies can be implemented.

Media selection choices that can affect student social presence are fairly simple. Many online class environments make use of simple static web pages that include photographs. Referring back to Russo's (2000a) thoughts about the use of the instructor's photograph in her online class being partially responsible for the perception of a higher degree of social presence on the part of the instructor, it is no great leap to think the same could work for students. Therefore, placing student pictures in a course website where they can be seen by fellow students may help raise social presence. Typically, inclusion of pictures in a web page is a low-cost and easily accomplished option for

raising social presence. Because richer media should tend to facilitate social presence of those using it, a course developer could examine ways that allow students to place their voice into an online environment. While there are low-technology options for facilitating the inclusion of student voices in online environments, they are not always reliable or high quality. Reliable, high quality methods of including student voices in online environments require greater technology investments and can be expensive if technical development personnel resources are used to make this happen. Synchronous media types tend to help create greater social presence, so if possible, media such as text-based chat or audio conferencing should be selected for appropriate activities. However, many synchronous media types require greater levels of technical equipment or knowledge on the part of students, which makes them more difficult to implement.

It is possible to develop or modify course activity structures to help create greater development of social presence. One common structure is a face-to-face first session. Having students interact in a face-to-face mode early in the class allows them to begin forming personal relationships that may be maintained or extended via online activities. Another way to alter activity structures to help raise student social presence would be to ensure that students work in small groups with each other. Because it seems to take more time to build a relationship in an online environment, it might be advisable to form persistent student groups that work together online via computer-mediated communications, on a variety of topics throughout the course.

Effective interpersonal communication practices can be an important way for students to raise their social presence in an online class. These effective interpersonal communication practices are similar or identical to face-to-face practices, but they tend to be harder to achieve in mediated contexts. Because of this it may be useful for an instructor to review these, and model for students ways to implement them in computer-mediated environments. A specific technique includes restating what another has communicated. While cutting and pasting another person's words is possible, this is not as effective at raising social presence as taking the time to restate the points made by another in your own words. Another technique students may use to raise social presence is to ensure that they respond to others as quickly as possible. Further, students should make sure that their responses are appropriate and related directly to the other person's previous communications.

Conclusion

Raising student social presence in an online class may help to better replicate some subjective impressions of quality of experience on the part of students. Media richness and social presence theories can provide information to the developers of online courses in their attempts to achieve this. There are various factors that might be considered in such an attempt. These include technological factors, such as using media technologies that have the greatest ability to carry information. Also included are structural factors that include designing class and student interactions in such a way as to ensure that students communicate more effectively and at deeper levels with each other.

Currently there is a transitional trend in online education, attempting to fit the traditional practice of the face-to-face classroom to the new technologies. Comparisons between the effectiveness of online education and face-to-face modes are a natural result. Where these comparisons find online education lacking is in the affective impressions of students about their interactions with other students, and in some cases the instructor. This may be because current computer-mediated communication methods tend to use leaner media. As bandwidth increases, hardware innovation infusion increases, and technical ability on the part of students becomes more advanced. Because of this, the use of richer media forms such as desktop video conferencing can eventually be expected to make their way into online education. Too, new forms of electronic communication will no doubt be developed. Until such a time, however, it may be useful to investigate lower-tech ways of increasing the social presence of students in online classes.

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Single-handed in Cyber Space – How to promote Teachers?

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Abstract: It is a matter of fact that we are facing a gap between the huge potential of new learning technologies, and their modest application in the classroom. In view of this situation, the seven Swiss Universities of Applied Sciences have decided to set up a joint initiative. Counselling is provided by some pioneers who already have started, or just are starting to build specific knowledge in the field of new learning technologies. The partners are setting up a network of competence, with the main purpose of instructing and motivating a broader group of interested teachers. The network is conceptualised as a 'learning organisation', where each member acts as an individual learner, who shares his insights collectively with his peers.

Introduction

In the best of all worlds, the situation of a teacher who would like to implement new learning technologies is comparable to the mission of an astronaut. The whole venture is planned in a thoughtful way over a period of months, and it is based on the collaboration with experienced designers, mentors, or technically competent assistants. In the real world, this ideal situation is a wishful dream. A teacher is rather comparable to a pioneer, who makes a single-handed attempt to row with his dinghy across the Atlantic. Teachers who are new to online course authoring often just have a vague idea of how to use web-based elements in their courses. They hardly know what the potential benefits of the new learning technologies (NLT) could be, and how much effort is required to implement some useful and pedagogically effective learning scenarios. More over they have great difficulties finding training that is adapted to their situation, and finding an expert capable of giving appropriate counselling. Nevertheless there are quite a lot of teachers who are motivated to use NLT in their courses. How can they pull themselves up, and how can we support their efforts?

Fighting Fire with Fire

The seven Swiss Universities of Applied Sciences (UAS) have decided to set up a common service named 'Forum New Learning' (cf. http://www.fnl.ch), which is part of the program 'Swiss Virtual Campus' (cf. http://www.virtualcampus.ch). In contrast to comparable institutions, the service and counselling will not be carried out by a geographically central office, but through a distributed network of persons, which consists of an avant-garde of teachers who already have, or just are starting to build specific knowledge in the field of NLT. These pioneers are setting up a network of competence, with the main purpose to instruct and motivate a broader group of interested teacher to gradually build a generalised competence in the use of NLT. This 'Learning Organisation' will act as a self directed body. Each member will organise her or his learning individually, but shares the insights collectively with the peers.

The objective of the project is to initiate and implement this community and to support its development. Some of the main tasks to reach this goal read as follows:

- *Education*: Set up a pool of web-based courses for the training and education of teachers in the field of NLT.
- *Tool Sharing*: Provide, maintain and administrate tools and platforms at different sites within the network.
- *Networking*: Organise mainly virtual discussions, panels, seminars and workshops. Set up rules and tools for community building on the web.
- *Knowledge Sharing*: Build and maintain an interactive learning portal, to allow partners to file and exchange didactical knowledge. Collect, adapt and provide available technical and didactical material.
- *Support*: Define the profile of expertise for each of the peers and stimulate bilateral advice.
- *Technology Watch*: Evaluate and discuss possible future trends within the community.

Steps towards a Learning Community

The translation of the above mentioned general objectives into practical measures and steps have so far resulted in the following products:

- *Workshops*: Based on teachers needs at the UAS, three different kind of single-day, web-based, face-to-face courses have been developed in German, Italian and French. With these three workshops we can tackle the most basic needs: creating web pages, using WebCT as a teaching platform, implementing web-based learning activities. These practical hands-on workshops provide technical as well as pedagogical know-how, and they are a starting point for setting up group activities with regard to the intended learning community. So far about 250 teachers have participated, many of them 2 or 3 times.
- *Server based platform:* We currently host about 100 on-line courses using WebCT on a dedicated server. Around 2000 students are enrolled in these courses. Teachers from the seven Swiss UAS can fill in a web-based application form, and within 48 hours an empty WebCT course is created for their class. The course is accessible around the clock, 7 days a week from any where in the world with any web browser.
- *User Group:* A specially designed course platform allows members – currently about 50 German speaking teachers - to meet, exchange and use a shared file data base. About 50 documents provide training as well as hints and tips for areas such as the use of the WebCT platform, the design of online learning material, and related pedagogical questions. In the electronic forum the members currently debate technical and pedagogical problems which they have encountered in their online courses. The exploitation of the first 6 month of discussion in the forum have already resulted in the creation of a FAQ. A first specialisation among the members begins to emerge. For example one teacher is the reference for the integration of mathematical formulas, another for the use of quizzes, and a third for browser related problems. More elaborate material contributed by the members is still sparse but has started to arrive. The user group is also a place to allow members to experiment methods and tools which they would like to use with their students. A monthly virtual get-together in the chat room for example has resulted in a collection of rules for using the chat tool.
- *Help desk:* With limited resources we give our best to provide rapid answer by phone or mail to NLT related questions from members of the learning community. This can imply to forward the request to a more knowledgeable person, to point to a web based information source, to refer the question to the user group, or to search for a solution by entering a course together and by retracing an operation to find the source of the problem.
- *Core knowledge representation:* A first collection of about 150 documents contains description of tools, examples of their use, proven tasks and exercises which can be implemented with them, guidelines and pedagogical considerations, reports of teachers experience, and lists of links to further material.
- *Web portal:* For the moment our three-lingual site (http://www.fnl.ch) presents the 'Forum New Learning', informs about the learning platform WebCT, guides teachers to the FNL-workshops, and allows the online request for the user group and the online application for the installation of a course. This actual site will be replaced by a more comfortable web portal, which will allow to customise a personal view, to subscribe to individual push-services, to upload bits of knowledge, to rate available information, or to post one's personal opinion.

How to bridge the Gap?

It is a matter of fact, that we face a gap between highly sophisticated technology and marginal knowledge about it's didactical use. This is the point where the project 'Forum New Learning' starts. Instead of complaining about the situation, we try a kind of bootstrap. This metaphorical term used in computing means that you have to raise yourself by your own bootstraps. In our case we try to pull us up by the power of a learning community. Quite a lot of managers are thinking about things like knowledge management, organisational learning, or intellectual capital. Why should we ignore such trends at the universities? Wouldn't it be a considerable return of investment, if faculty development could close a reinforcing loop, where teachers are not only taught on new learning technologies, but where they also return a lot of practical and didactical knowledge, which again can be used for faculty support?

The Impact of Culture in Designing Web-Based Systems

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Abstract: The success of ecommerce could depend on the effectiveness of managing cultural differences of users from different parts of the world. Several HCI researchers are currently exploring many aspects of culture that can influence interface design. However, cultural studies in HCI are still very limited. To localize an interface by taking cultural factors into account must be considered with care. The paper critically reviews a large number of studies that explored the impacts of cultural elements in human information processing. The paper categorizes such studies into three major aspects: representational, cognitive, and attitudinal aspects.

Introduction

International Data Corporation (IDC), estimates that the number of Internet users in the world will be about 500 million by 2003; and 62 percent of the US population will be online by 2003 (IDC, 1999). Computer Economics Inc. reports that by 2002, non-English-speaking Internet users will be the majority (Bodeux, 2000). Currently, many HCI researchers are focusing attention on culture as a potentially influencing factor that can affect user performance and satisfaction toward an interface. The internationalization and localization concepts are frequently employed in developing cultural-based interfaces. Internationalization, commonly known as "I18N", refers to the process to eliminate the culturally specific elements such as color, text, image, and icon from an interface as much as possible. As a result, the interface can be easily adapted to use in various countries, cultures, and languages. In contrast to internationalization, localization, commonly known as "L10N", refers to the process taking culturally sensitive elements into account in software development.

Concepts of Culture

Culture is an abstract, complex and problematic term (Barber & Badre, 1998). It has been defined in various aspects. Hofstede (1991), for instance, defines culture as "software of the mind," that is, "the collective programming of the mind which distinguishes the members of one group or category of people from another". Culture might include behavioral products, values, languages, ways of life of ancestors, art, music, shared preferences, rules, norms, attitudes, and beliefs (Segall et al., 1999). Cultural elements are transmitted, shaped,

shared, and taught among people in each particular culture, thereby differentiating a culture from one another (Segall et al., 1999). Hoft (1996) presents two layers of culture, namely, the objective layer of culture and the subjective layer of culture. The objective culture contains cultural elements, which are visible, tangible, and easy to examine and understand, such as, colors, graphics, sounds, arts, symbols, heroes, pictures, and literatures. This layer can be changed from time to time. In contrast, the subjective culture is invisible and substantially difficult to examine and understand since this cultural layer deals with beliefs, values, and behaviors such as a sense of time, personal space, a sense of group belonging, and seniority.

Impacts of Culture in Human Information Processing

The purpose of cross-cultural cognitive psychology is to understand human information processes which are influenced by cultural factors (Segall et al., 1999). These processes include perception, memorization, attention, reasoning, learning, categorization, and problem solving. Followings are discussions on a large number of existing surveys and empirical studies on cultural interface designs aiming to facilitate human information processing. Such studies are categorized into three major aspects: representational, cognitive, and attitudinal aspects.

Representational Aspects

Most of cultural issues in HCI are related to representations of interface elements such as colors, languages, icons, symbols and images. Differences in visual perception of interface representations among people from different cultures exist because they perceive things in a way that they have experienced and learned (Segall, et al., 1999). In other words, environment and culture shape humans' perceptual practices. In recent years, most of the empirical studies with regard to the design of cross-cultural interface attempt to examine the question of whether cultural diversity affects visual perceptions. Language is a major concern in representational aspects. Unquestionably, language translation seems to be difficult since languages which are the products of cultures are extremely complex. Nevertheless, it is necessary to translate software and Web sites into users' native languages since users more easily and effectively process information in their own languages than in foreign languages. Users tend to prefer to process information in their native languages rather than second languages (Nielsen & Mack, 1994; Tractinsky, 2000). To process information presented in second languages can cause users more stressful. Accuracy in meaning is the main concept of language translation. Shades of meaning in languages are different across cultures. Moreover, in some cultures such as Thailand, languages also show social status, and therefore, appropriate vocabularies must be carefully selected to use with people who have different societal status. Results from empirical studies on language translation for computer applications vary. Very recently, Tractinsky (2000) proposes a theoretical framework for the study of user interface translation. Factors in this framework include costs and benefits of venders and users in software translation. The study categorizes components in software language translation into manipulation language, system messages, and system documentation. The major findings indicate that a fully translated interface, which contains the three components above, is the most effective approach, whereas only the manipulation language translation is the worst. However, Constantine and Lockwood (1999) state that users' expertise levels on computer systems can affect users' performance and preferences. Expert users might prefer to use English language interfaces rather than their own native language interfaces. AlHanaiyyan et al. (1999) investigate Kuwaiti and British students and experts evaluating translated and English interfaces. They found that student subjects preferred to use interfaces in their native languages, while expert subjects from both cultures preferred English interfaces. Barber and Badre (1998) have conducted a usability inspection on 168 Web sites originating in different countries and languages aiming at analyzing cultural elements used in Web design (e.g., colors and icons). The results indicate that there are differences in cultural element usage across cultures and genres of Web sites within each culture. Studies on cultural impacts in icon design also exist (e.g., Evers, et al. 1999; Piamonte, et al. 1999). For instance, a series of studies aiming at evaluating three sets of videophone icons and pictograms developed in Japan, the US, and England by Piamonte et al. (1999) show the effects of cultural differences in memory testing toward icon design. The studies indicate that symbols could be easily recognized and confused. In terms of metaphor design, Evers et al. (1999) attempt to explore cultural differences in perception toward metaphor design of virtual campuses. The studies conclude that users from different cultures perceive the meanings of metaphoric graphics differently. Another study, which is conducted with 111 Korean, 16 Japanese, and 22 American subjects, explores the relationship of user preferences on the simulated microwave oven interface (e.g., interface hierarchy, label, and layout) and a set of cultural characteristics (e.g., nature of human relationship, sense of space, perception, language, and sense of time) (Lee & Harada, 2000). In terms of the depth of hierarchical

interface (deep/shallow) and the label of elements of the interface (verbal/graphic), the study shows that Japanese tend to prefer a deep interface structure and a verbal label, whereas Korean and American prefer shallow structure and a graphic label. However, user performance tends to have a negative relationship with user preference toward an interface.

Cognitive Aspects

Other than studies of culturally representational aspects in interface design, some culturally cognitive studies have been investigated. One study points out that relationships among cultural factors and cognitive functions are often recognized (Poortinga & Vijver, 1988). Apparently, researchers and practitioners cannot deny that human cognitive processes vary across cultures. Segall et al. (1999) also mention that basic cognitive functions of human are similar, however, by shaping with cultural experiences, human applied their preferred skills and strategies to their cognitive processes in each particular situation differently. Most of studies in culturally cognitive aspects are comparatively conducted between Chinese and American subjects. Choong and Salvendy (1998), for example, report cultural differences in visual perception perspectives on user performance between American and Chinese users in two studies. First, they explore the impacts of cultural differences with icon displays: icons with alphanumeric elements only, icons with pictorial elements only, and icons with alphanumeric and pictorial elements. The results show that Chinese users have better performance and fewer errors in using icons with pictorial elements and icons with alphanumeric and pictorial elements because Chinese language learning is related to visual processing. In contrast, American users have better performance and fewer errors in using icons with alphanumeric elements and icons with alphanumeric and pictorial elements. In another study, Choong and Salvendy (1999) explore menu interface design in relationship to differences in thinking styles between Chinese and American subjects. In the study, menu interfaces represent the concepts of knowledge representation and interface structure. Two types of knowledge representation include concrete representation and abstract representation. Two levels of interface structure include functional structure and thematic structure. The study indicates the differences in performance between Chinese and American subjects. For the Chinese users, performance increases in an interface with concrete representation and in thematic interface structure. In contrast, American subjects perform well on functional interface layout with abstract representation. The rationale behind this finding is that cognitive styles between Chinese and American are different. The study cites a study by Chiu (1972) that shows that Chinese prefer to categorize stimuli on the basis of interdependence and relationship, while American prefer to analyze stimuli based on the stimuli's functions. Nevertheless, little reliable research exists to confirm the cultural effects in menu design. A study by Shih and Goonetilleke (1997) investigating computer menu design with Chinese subjects in Hong Kong reports that user searching speed is faster in the Chinese version menu than in the English version menu. They conclude that in both Chinese version and English version menu designs horizontal oriented menus are more effective than vertical oriented menus. However, in a comparative study between Chinese and American subjects, Dong and Salvendy (1999) report that in vertical-oriented Chinese menus are more effective than horizontal ones.

Attitudinal Aspects

To measure how users perform and how they think about the system are equally important. Similar to user performance, user attitudes or judgments in experiencing the system are different across individuals, which affect how users use the system in the later time. Culture plays an important role in shaping and influencing how users think and feel toward a stimulus. People use their attitudinal framework thought by cultural groups that they belong to evaluate new stimuli (Segall et al., 1999). Researchers points out that studies on the subjective layer of culture are also necessary since feelings, values, tastes and beliefs can influence human interaction with computer technologies (Fernandes, 1995; Hoft, 1996). In cultural interface design, very few empirical studies have been explored subjective usability evaluation. Most of such studies are related to interface aesthetics. A study in attitudinal aspects by Evers and Day (1997) examine roles of cultural factors in interface acceptance among Chinese, Indonesian, and Australian. The findings confirm the differences in interface acceptance from people who have different cultural backgrounds. Chinese tend to value in the usefulness of the system rather than ease of use, while Indonesians tend to value in ease of use rather than usefulness of the system. Australians' preferences are based on their satisfactions on interface regardless of ease of use and usefulness of the system. Ever and Day suggest that Chinese tend to user a system that has useful interface, even though that interface is difficult to use. In contrast, Indonesians will not be likely to use a system that its interface is difficult to use. Relevant to Ever and Day's study on interface acceptance across cultures, Day and Ever (1999) develop a questionnaire to access cultural factors in computer interface acceptances. In evaluating interface design, usability and aesthetics are often debated whether which one is more

important. Users attitudes and preferences toward usability and aesthetics of the system are important to interface acceptance. Both of these concepts could be influenced by cultural backgrounds of users. Usability, a core concept of HCI, refers to the characteristics of user interface that is easy to use, learn, and remember, pleasant to use and has least errors (Nielsen, 1993). Interface can be designed to reach usability concepts by understanding these factors (e.g. cultural backgrounds, ages, and computer experiences) that determine how people think and perform the system. Cultural backgrounds could also affect designers' ideas in designing interfaces. Designers develop their systems based on their assumptions, while their users perceive those systems with their own assumptions (Kaplan, 2000). Due to different thinking styles, attitudes, feelings and behaviors of users influenced by their cultures, users from different cultures might perceive usable elements or concepts differently. In Web design, for instance, most Web usability guidelines are developed with an American perspective. What Americans perceive as usable, might be not usable in other countries or cultures, and vice versa. Differences between Thai and American cultures clearly affect Web design (Noiwan & Norcio, 2000). The major differences between Thai and American Web sites are visual designs and designs of structure of information. However, no evidence that these so-called undesirable interface elements as mentioned above are also unusable among Thai users has been reported. The Thai web designers' design styles might be influenced by some certain levels of their patterns of thinking, values, and beliefs. In another study that also attempts to analyze cultural issues in Web design, Stanley and Speights (1999) report the differences in Web design found between Mexican and American radio Web sites. Mexican Web sites are considerably designed by using a lot of graphics, which are more colorful and larger in size than American Web sites. Animated graphics and splash Web pages are usually found. Information presentation is also different; for example, many topics are presented in a single page. The study also reports that Mexican Internet users tend to prefer a non-hierarchical organization of information.

Some empirical studies have been conducted to explore the importance of aesthetics in interface design. Tractinsky (1997), for example, replicates the study of Kurosu and Kashimura (1995) which conducted with Japanese subjects. The study aims at investigating the relationships among aesthetics, apparent usability (a priori perceptions of the ease of use) and a set of inherent usability factors (e.g., location of the display, type of keypad, and grouping of keys) of 26 ATM interface design layouts with Israel subjects (Tractinsky, 1997). The results from both studies show that apparent usability significantly correlates to aesthetic in a positive direction, whereas inherent usability is not effective in explaining apparent usability (Kurosu & Kashimura, 1995; Tractinsky, 1997). Tractinsky (1997) also suggests that the degree to which aesthetics relate to usability is culturally dependent. The senses of aesthetics are markedly different from culture to culture. For instance, Japanese clipart looks lovely and "cute" whereas American clipart looks formal. It is suggested that the degree to which aesthetics relate to usability is culturally dependent (Tractinsky, 1997). Noiwan and Norcio (2000) express that it might be reasonable to assume that Thai aestheticism influence the designers' considerations in using graphical elements in Web design due to differences found in visual designs and information structure comparing with American Web. In color studies which related to cultural aspects, as cultural backgrounds could influence learned responses and reactions to color (Eiseman, 2000), color preferences might be considered culturally dependent. A challenging question, "are there universal color preferences that humans like or dislike?," has been asked on a cross-cultural basis for many years. Research on color preferences markedly varies. However, a trend in studying color in interface design across cultures is crucial. Hall (2000), for instance, ensures his belief of differences in color preferences across cultures by showing the recent study by Musashino University of Fine Arts in Tokyo that uses more than 5,000 subjects across 20 nations. Based on the study, the differences on color preferences are categorized into three major groups of nations and the differences on color associations are categorized into five major groups. Hall (2000) also cites another evidence that shows that photo businesses in Japan are concerned about color differences among regions. People in Tokyo, Osaka, and Fukuoka, for example, have slightly different preferences; therefore, the shades of color in the developed prints in each market are slightly different. Barber and Badre (1998) report preliminary differences in Web color design. For instance, based on that study, government Web sites in Brazil are designed by using a variety of colors, whereas the majority government Web sites investigated in that study are designed by using national colors throughout the sites. The study suggests that the preference for many colors in designing Brazil's Web sites is culturally dependent. Furthermore, a study by Duncker, et.al. (2000) also shows the preliminary results in usability testing on cultural interface design of digital libraries that subjects with different cultural backgrounds have different color preferences. English participants tend to use pastel color schemes with gray and low contrast. In contrast, Scandinavian participants tend to use dark colors also with low contrast. Jamaican participants tend to use bright colors with high contrasts and colorful schemes. African participants tend to use black as background. European and American participants tend to use bright background with black text and few moderately colorful objects. However, no pattern is found in color use by Asian participants. Several efforts in determining cultural factors in color preferences still continue.

Conclusion

The paper attempts to discuss the efforts of HCI researchers in understanding cultural impacts in human information system. Developing successful computer interfaces, either for software or Web sites, require careful considerations on language translation and implications of culturally sensitive elements. Ignoring cultural issues, to make interfaces standard for all users around the world might not be a right solution. Rather, such interfaces should be designed to fit with intuitive usability in representational, cognitive, and attitudinal aspects of users in each particular culture, since users from different countries not only speak different languages, but also have different cultures that make them process information, think, feel and act differently.

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Between-Page Banner Advertising (BePBA) on the Web: A Solution Where Usability and Advertising Meet

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Abstract: Animated online advertisements on Web pages cause difficulty for users to acquire information on such Web pages. As a result, users learn to ignore banner advertisements. It consequently causes ineffectiveness of online advertising. This paper proposed the new technique for banner advertising placement, called Between-Page Banner Advertising (BePBA) in which it places a banner during the transition from one Web page to another. This technique promises to increase effectiveness of advertising while minimizing the usability defection of online banners.

Introduction

Unlike printed publications and broadcastings, World Wide Web (WWW) is a relatively new medium that has been invented only less than a decade ago. As a result, it still has a large number of issues open for studies in order to improve the use of this upstart media effectively. During the emerging period of the Web, it is generally considered as an alternative of printed publications in which it contains richer interaction capabilities and wider accesses. For that reason, techniques studied for printed publications are usually extended to the Web. However, because the Web holds a number of its unique characteristics that noticeably differs from printed publications, several techniques fail its purposes and raise usability problems. Among them, techniques for placing banner advertisings on Web pages face serious failure and causes severe usability issues. Nevertheless, advertising is currently the primary source of revenue for most Web sites. Therefore, the issue on effectively delivering banner messages to Web users becomes vitally important. In this paper, a technique to place banner advertisings on Web sites called Between-Page Banner Advertising (BePBA) is presented as a solution for Web advertisings. BePBA is expected to deliver banner messages effectively at minimum usability interferences. An experimental study on the effectiveness of BePBA is also proposed in this paper.

Trend in Banner Advertising

On-line advertising has increased its significance to businesses around the world. Since then, among various types of on-line advertising media (e.g., banners, buttons, and text links), Web banners have become the

most widely used on-line advertising media (Meland, 2000). High expenses on Web advertising spent by Web advertisers over the years have created high revenues to Web publishers. A very recent report shows that Merrill Lynch predict no growth in on-line advertising in the year 2001, whereas IDC and Forrester Research predict 12 percent and 36 percent growth, respectively (Lawrence, 2001).

Navigation Problems

Navigation, the most important activity performed on the Internet, refers to the process of moving from one route to another by examining the chosen route from data, knowledge and experience observed from environment and built up in mental model (Borges et.al., 1998). World Wide Web (WWW) is always recognized as an alternative of printed publications. Thus, techniques used for printed publications are frequently employed to the Web. Nevertheless, the Web contains several characteristics that noticeably differ from printed publications. The most significant difference is that the Web lacks obvious navigational structure, whereas printed publications, as tangible objects, express their navigational layouts explicitly. As a result, the problem of navigational structure for the Web is largely concerned than do printed publications. Moreover, in contrast to people who read information from traditional media, on-line readers deal with more activities while reading, such as replying to emails, navigating Web sites, and chatting on-line (Lewenstein et al., 2000). As a result, Web users report the "cognitive overload" problem. The problem occurs when a user is overwhelmed with performing several on-line tasks simultaneously (Pilgrim & Leung, 1999). Occasionally, users also experience the 'lost in space" problem, i.e., users may not remember which Web pages they visited before reaching the current page (Pilgrim & Leung, 1999). Other than these problems, a Web page itself contains objects that can distract users such as graphics, video clips, images, and banner advertisings. In other words, reading online requires one to deal with more distractions than reading from paper.

Usability Problems of Banner Advertisings

Understanding strategies in acquiring desired information on-line is essential and guides research and practices in Web page design. For instance, a current study in Web reading and eye tracking shows an interesting investigation on human visual attention patterns when seeking information on newspaper Web sites (Lewenstein et al., 2000). The preliminary results show that on-line readers fixate their eyes on abstracts or captions first, and then graphics and images second. More interestingly, this study also shows that subjects look at 45 percent of all banner graphics displayed on the screen, which is considered a significant percentage for on-line advertising. The average time of eye fixation on these banner advertisements is 1 ¼ seconds. Moreover, other empirical studies provide evidence that Web users experience reading concentration difficulty on Web pages containing animated graphics (Nielsen, 2000; Spool et al., 1999). Despite the proliferation of animated on-line banner advertising on Web pages, Web users report difficulty in acquiring information on such Web pages. To date, only a few researchers have explored usability perspectives of animated banner-advertising effects in information seeking on Web pages (e.g., Zhang, 1999). In fact, a number of current Web sites are designed to use rapidly animated, highly colorful banner advertisements aiming to gain "click-through". In Web page design, it is recommended to minimize the use of animated graphics and promote using non-animated or static graphics (Nielsen, 2000). Moreover, according to a study of Web usability by the User Interface Engineering Company, even though animated advertising banners are more effective at gaining click-through than static banners, animated advertising banners may not communicate their messages to users (Spool et al., 1999). Rather, animated banners can distract user attention in retrieving desired information on the Web pages (Spool et al., 1999). Thus, the study recommends that Web designers should be concerned about the purposes of Web sites in considering using animated graphics. For instance, using animated graphics on commercial Web sites might be more appropriate than using them on informative Web sites. Yet, with the rapid growth of business competition on the Internet, companies need effective advertising media to attract potential Internet customers. The trend in placing banner advertisings on Web pages might be inevitable, since businesses, particularly "dot-com" companies, can corporately gain revenues and increase brand awareness from banner advertising. Many Web sites can exist in the Internet because of revenues gained from banner advertisings. For instance, news and media Web sites e.g. Yahoo are able to provide news for free to Web users because the companies gain revenues from banner viewing and clicking. Nevertheless, experienced Web Users might have learned to ignore banner ads. The Internet advertisers attempt to force Web users to look at the banner ads and hope to gain click-through rates. Recently, the Internet Advertising Bureau (IAB) has proposed the new banner ads

guidelines by making larger ads, 250-by-250 pixels and 120-by-600 pixels (Kapadia, 2001). Several Internet media companies have already been using these new-sized banner ads such as Yahoo (http://www.yahoo.com) and CNET (http://www.news.com). However, intuitively, users seek for their desired information and they do not want to see any distracted elements of the Web pages. Therefore, the harder the users try to ignore banner ads, the more they feel annoyed. This recent attempt of using actively animated and relatively large advertisements, as agreed by major Web sites, may be still ineffective and in turn causes larger usability problems. However, if banner revenues are continuously decreasing, such companies might employ subscription technique with Web users in accessing to news from their Web sites.

Related Studies in Banner Advertisings

Researchers and practitioners have responded enthusiastically to on-line banner advertising. While advertising researchers might attempt to answer how many times users actually see the banners and how many Internet users visit the advertised Web sites, the HCI people might attempt to explore how Internet users process information while they navigate the Web site containing banner advertisings. Current studies in an advertising arena express concern over understanding banner-clicking processes to increase a click-through rate - a percentage of visitors who click on banner advertising. Cho and Leckenby (1999), for instance, explore a level of user involvement in clicking on Web banners. Another study develops the model of banner clicking by focusing on several variables of banner advertising such as size and animation (Cho and Leckenby, 1999). The studies show that a variety of banner factors such as animation, color, banner message, and location can influence such processes. In cognitive psychology, however, very few studies regarding cognitive processes of human interacting with on-line banner advertisings have been conducted (e.g. Noiwan & Emurian, 2001; Noiwan & Norcio, 2001; Zhang, 1999). Two attributes of objects that can distract visual attention the most are motion and color (Constantine & Lockwood, 1999). Several empirical analyses provide evidence regarding the effects of graphic motion on visual attention. In the periphery, moving targets are detected more easily than static ones (Ware, 2000). Other studies by (Faraday & Sutcliffe, 1997) conclude that motion has strong attentional effects. Another study by Hillstrom and Yantis (1994) conclude that objects presented in a loop of appearance and disappearance can attract attention. Ware et al. (1992) point out that speed of objects also affects attention, for example, a rapidly moving target is harder to ignore than a slowly moving one. A recent study by Zhang (1999) reports significant differences in different conditions of animated graphics in on-line information seeking. The results show that the animated graphics worsen user performance in searching for the target words. For example, an animated graphic that is similar but irrelevant to a task distracts a user's attention more than an animated graphic that is dissimilar to a task does. Such results become more negative when users are instructed not to ignore the animated graphics. Nevertheless, in terms of advertising banners, animated ones tend to be more effective in increasing a click-through rate than static ones. Noiwan and Emurian (2001) investigate the effects of target word density (i.e., high, medium, and low) and Web page presentation styles (i.e., no graphics, static graphics, and animated graphics) on search time and user preferences. The results show a significant effect of target density on search time. Search time on low-density pages is significantly briefer than on high-density pages, an outcome that validated the experimental protocol. No significant effect is found for page presentation style, and the interaction between target density and presentation style is not significant. Self-report data shows that static graphics pages and animated graphics pages are sometimes perceived differently in terms of usability and aesthetics, and both styles are perceived as visually appealing to users.

Between-Page Banner Advertisement (BePBA)

Technique

As its name implied, BePBA refers to the technique of displaying banner advertising between two Web pages during the transition of one Web page to another, as shown in the figure 1. Generally, the Web page transition period is the moment when users wait for a next Web page to display. However, not every single Web page that the user visited will follow by a transitional page for banner ads. Rather, the transitional page will be displayed only when reaching some possible criteria (e.g., numbers of the clicked pages or time of navigating through the Web site). Only one banner advertising with 480 x 360 pixel size is limited to one transitional page, as shown in the figure 2. Before a user reaching a transitional page, the informing message about the upcoming transitional page will

be displayed in the current Web page. The message aims to inform the user that the transitional page will be shown before the Web automatically taking the user to the page that the user is about to click.

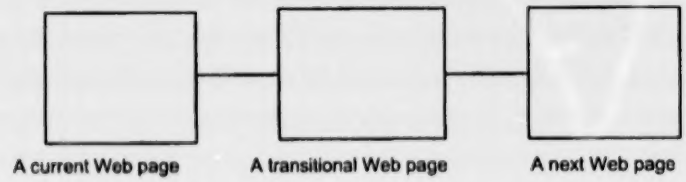

Figure 1. The concept of Between-Page Banner Advertising (BePBA) technique.

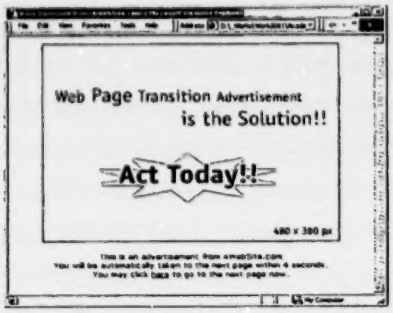

Figure 2. An example of Between-Page Banner Advertising (BePBA).

Usability Effectiveness of BePBA

An interface plays a role as a mediator between a user and a computer system; and therefore, it should effectively support human information processing by facilitating performance (e.g., speed and accuracy) and satisfaction. Usability, a core concept of HCI, refers to the characteristics of user interface that is easy to use, learn, and remember, pleasant to use and has least errors (Nielsen, 1993). Nielsen develops the comprehensive guidelines to encounter with usability issues, namely, (1) visibility of system status, (2) match between system and the real world, (3) user control and freedom, (4) consistency and standards, (5) error prevention, (6) flexibility and efficiency of use, (7) aesthetic and minimalist design, (8) help users recognize, diagnose, and recover from errors and (9) help and documentation (Nielsen, 1993). Current evidence supports the facts that the current banner placement technique, or within-page technique, as opposed to between-page banner advertising technique (BePBA), annoys users while they seek for information on Web pages (e.g. Nielsen, 2000; Spool et al., 1999; Zhang, 1999). From a theoretical point of view, these users experience the difficulties because they automatically divide their attention to both stimuli: textual information and banner advertising. Attention resource of human is limited in nature, and therefore, attention is a human capacity that can control human response (Wickens & Hollands, 2000). When attention is divided, performance on each task could be lessened. In other words, when more than one task is performed simultaneously, they compete with one another for available limited mental resources, which may finally decrease task performance. Wickens and Hollands (2000) emphasize that two tasks can interfere with each other when they have the same stimulus modality either visual or auditory. In other words, tasks can be performed more easily when each of them is using a different modality. Rather than imitating printed publication concepts, BePBA employs broadcasting media concepts and promises better usability aspects comparing with the within-page banner advertising placement technique. First, by using BePBA in which banner advertising is located in a transitional page between two Web pages, Web users are allowed to use their full attention span to only the context of the Web pages, and therefore, prevent errors and dissatisfaction in navigating through the Web site. Second, BePBA technique promotes the concept of aesthetic and minimalist design. By separating banner ads from textual Web pages, Web pages containing textual information have more space for Web designers to design visually appealing Web pages. Likewise, banner ads in the transitional page, with the size of 480 x 360 pixels, provide enough room for graphic designers to design more creative and visually appealing banner ads as well. Third, to eliminate the lost in the space

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problem, BePBA provides users with only necessary information along with displaying advertisement during the transition of a Web page to another. Such information includes time to display the ads, the current location of user navigation, and the link that can automatically take the user to the next page. Forth, another proposed idea that comes with BePBA is the idea of embedding a new HTML element into the HTML tag. This new tag will facilitate all Web designers to use the same standard in integrating banner ads into Web pages. The new tag that may locate in the header section of HTML may be written as `<AD src="/ad/ad1.gif" delay="5">`. This tag instructs Web browser to display the graphic file located at /ad/ad1.gif for 5 seconds before loading a new Web page. Fifth, another idea that comes with BePBA is the proposed ability of Web browser in which the Web browser should be able to save the banner advertising links that users are interested for later visits. Unique numbers of Web sites that placed these banner ads might be kept together with the ads, and therefore, click-through rates could be gained when the users click such banner ads. Sixth, BePBA emphasizes the importance of predictability in displaying the transitional Web pages for banner display by using some possible criteria such as numbers of the clicked pages and time of navigating through the Web site. This technique could reduce annoyance while users navigate through the Web. Lastly, BePBA promotes error prevention by informing a user before reaching the transitional page.

Advertising Effectiveness of BePBA

By implementing the concept of broadcasting media such as television, BePBA aims to increase brand awareness rather than click-through rates (CTRs). Time to display banner ads in the transitional page is the key factor of revenue gaining for Web publishers. Four to six seconds for banner display are presumed to be the promising time that may increase brand awareness and retain user memory from the last visited page. Theoretically, Wickens and Hollands (2000) explains that human's sensory system has an associated Short-Term Sensory Store (STSS) that places within a brain for extending the representation of the raw stimulus. Thus, if a user is distracted while the information is being processed, the user can recover its contents for a few seconds. Accordingly, BePBA is expected to deliver advertising effectiveness with small interferences to the current tasks of users.

Future Works: The Experimental Study

To satisfy Web advertisers, Web publishers, and consumers in on-line businesses, effective banner advertising must be designed and banner techniques must be continuously invented, so that users click on the banners with enthusiasm and use minimal cognitive processes to react to stimuli on the Web pages with pleasure. More importantly, a banner should not decrease visual appeal and usability of a Web page. However, empirical evidence, in terms of cognitive perspectives in human information processing on Web sites containing animated banner advertisings, are remarkably scarce. Still, on-line information seeking has quickly become a daily activity for humans and a number of Web publishers have quickly increased to provide current on-line information and archives for their customers through the Internet. The study will evaluate the concept of BePBA by utilizing a target-word searching task to compare the usability effects between the newly proposed BePBA technique and the current within-page technique of banner advertising. Within-subjects, full-factorial design will be employed. Within-subjects factors include banner placement technique (between-page banner advertising and within-page banner advertising) and banner types (static banner and animated banner). The dependent variables include total search time for the target words, target-word search accuracy, banner-word selection accuracy, and self-reports of usability. MANOVA approach will be used to examine the effects. Spearman rank correlation coefficients will be computed to show the strengths of relationships among dependent variables.

Conclusion

The paper proposes the new banner advertising placing technique, called Between-Page Banner Advertising or BePBA. The paper points out shortcomings of the current banner advertising techniques and presents the strengths of BePBA. Theoretical points of view with regards to usability and visual attention are mainly discussed. The proposed technique will be experimentally evaluated in comparison with the current technique. The proposed within-subject experiment is discussed briefly.

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Teaching with the 'Net

A project of Teaching Matters, Inc. and the Citigroup Foundation.

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A brief history of the Internet: it started where everything starts, the military. In 1962, the pentagon needed a way to transfer files, so they wrote a program for their computers to send messages back and forth. 1970 comes around and higher ed catches on; email and research become the primary uses. After the universities, the business world jumps on the bandwagon; and wherever there's a large number of people in one spot, there's a Gap commercial!

Finally, the Internet hits the schools. Someone figures out it's not just a fad, this is the new form of communication for the information age. However, like with everything cool, the kids already know more about it than we do, putting us in the ironic position where teachers of the world need some learnin', and fast! Well, this is where Teaching Matters Inc. (TMI) comes in. We're a NYC based non-profit K-12 professional development organization that uses the latest synchronous technologies to follow-up and enhance face-to-face training.

"Who cares, you say? E-Learning is nothing new!" Well, no, it's not, but neither is Teaching Matters. We've been working with teachers and principals in the public schools for over seven years. Sometimes we go to them; sometimes they come to us, but, New York City is a big town and we weren't satisfied helping only a lucky few when there were many in need. So, we redesigned our model to combine the best of instructor-led training with online convenience. Now, we have them stay put, we stay put, and the training gets done in our @School Anytime virtual classroom by our team of fifteen certified online instructors.

Our software is Centra Symposium. We searched out what business has been using, selected Centra for its live audio features, then tailored it to the kind of personal coaching that teachers and principals like best. When this state-of-the-art technology is paired with face-to-face professional development, online training provides teachers the opportunity (and convenience) to learn away from the hurly-burly of school where there is never enough time---or peace and quiet---to concentrate! (At least 200 new teachers will ultimately complete Teaching with the 'Net funded by the Citigroup Foundation followed by 60 principals in a subsequent program funded by AT&T).

Step one is a three-hour introductory face-to-face class where participants are introduced to their instructors and to one another, then given an orientation to the elements of distance learning and how to install the software at home. They are then eased into a virtual classroom where the familiar norms of their own seminars and classrooms are reviewed: raising hands, responding to questions, brainstorming and hands-on practice. One comment at the end of the day led us to believe that we made the right choice for our new online model.

"Thanks for a great day. I learned amazing things. Plus I enjoyed the company and welcomed the

sharing of ideas. All my days should be spent engaged in activities and around people who fuel me. I feel fully charged"!
Beverly Ham Sweeny, Teacher

Sunday February 25th saw our first online class. Twelve teachers signed on from home (in pajamas and shorts) using their own modems and ISP's (internet service provider) and took part in a ninety-minute session on searching the Internet. Twelve eager new teachers, all using their own computers, speaking to each other over headsets, going on Web Safaris, application sharing and, in general, having a great time. They didn't have to get into the car, cross a bridge or pay a toll, arrange for a babysitter, or even change clothes. Nothing was lost or missing from the traditional face-to-face classes. The same tools were there, the same instructors, the same conversations, and if you missed something, the whole class was recorded and ready to be played back. "This isn't distance learning, this is close and powerful learning", said our first evaluation.

Teaching with the 'Net is first and foremost about curriculum, not technology. Sessions include: Using Primary Sources, Black History, Analyzing Live Data, Publishing Online, the Concept of Probability, Communicating with E-pals, Creating Websites and Classroom Management among others. The technology was there, but the training was about integration. All for free, all thanks to the generosity of Citigroup.

By October of this year, at least two hundred new teachers will have graduated with credits, while proving to themselves that their pioneer adventure creates excitement around learning, both their own and the media rich offerings they can take back to their students.

We're not saying the Internet will replace in-house training. Quite the opposite, everyone needs that personal coaching, and there are just some things that don't work online. It's the combination of the two that brings out the magic. So what's to come? Our February cohort is finishing up with a 95% retention rate, and the second is starting early July. We are upgrading the software and server so everything will be faster and more easily installed.

We've also completed our first formative evaluation to improve our delivery and articulate for our funders what makes @School Anytime a compelling way to learn. Initial findings are not surprising: phone support and a friendly voice, help at the drop of a hat, instructors matched with students, a flexible TV Guide type of schedule, online community building with bulletin boards and email, but most of all strong content and face-to-face sessions to take the *distance* out of distance learning.

We're also bringing the teachers back to lead peer-to-peer sessions with the next group. Hartford, Connecticut will begin training their librarians online in July and 60 New York City principals are making the leap in October. We'll let you know when they tell us ***what's next***

Visualizing Knowledge Awareness in a Web-Based CSCL Environment

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Abstract: This paper describes an open-ended and collaborative learning environment in WWW. In the environment called *SharlokII*, the learners provide and share individual knowledge and other knowledge on the WWW and discuss about them. This paper focuses on *knowledge awareness map* and its design, implementation and evaluation. The map visualizes the relationship between the shared knowledge and the current and past interactions of learners. The map plays a very important role of finding peer helpers, and inducing collaboration.

Introduction

Recently, researchers in the educational systems area are attempting to provide technological support for cooperative and collaborative learning advocated by educational theories (Slavin, 1990; Webb & Palincsar, 1996; O'Malley, 1994). This paper focuses on an *open ended and collaborative learning environment*. For this situation, CoVis (Edelson et al., 1996), KIE (Linn, 1996), CSILE (Scardamalia & Bereiter, 1996), WebCamile (Guzdialet al., 1997) and Belvedere (Suthers & Jones, 1997) have been developed. CoVis focuses on making a collaboration process visible. KIE succeeds by helping students link, connect, distinguish, compare, and analyze their repertoire of ideas. CSILE and WebCamile support knowledge building for the creation of knowledge. Moreover Belvedere that is a networked software system, was implemented to provide learners with shared workspaces for coordinating and recording their collaboration in scientific inquiry. In such environments, distributed expertise and multiple perspectives enable learners to accomplish tasks and develop understandings beyond what any could achieve alone. Therefore, it is very important for learners to collaborate with each other. However, little attention has been given to the technical support for inducing collaboration in distributed leaning spaces connected via Internets.

In computer supported cooperative work (CSCW), *awareness* is one of the most interesting topics, which can increase communication opportunities in a distributed workspace. Dourish and Bellotti (1992) defined *awareness as "understanding of the activities of others, which provides a context for your own activity."* In CSCL (computer supported collaborative learning), *Knowledge Awareness* (KA) have been proposed to bridge learners who are interested in the same knowledge and to create effective collaboration in a distance learning environment (Ogata et al., 1996a; Ogata & Yano, 1997). KA gives learner information about other learners' activities in a shared knowledge space. Its messages are, for instance, "someone is looking at the same knowledge that you are looking at", "someone changed the knowledge which you have inputted." These messages of KA encourage collaboration by exciting learner's curiosity and by active learning. *Sharlok* (Sharing, Linking and Looking-for Knowledge) has been developed as a testbed of the KA (Ogata & Yano, 1996b). Sharlok is an open-ended and collaborative learning environment, and it integrates a knowledge building tool with a collaborative interface tool. Sharlok allows learners: (1) to share their respective knowledge in its shared knowledge space, and to explore this knowledge space freely, (2) to make hypertext links between relevant knowledge, and (3) to collaborate about shared knowledge in an ad hoc group at real time. Evaluation of Sharlok showed that KA encouraged collaboration by exciting learner's curiosity and that KA effectively induced collaboration (Ogata & Yano, 1998). However, the problem arises that it is very difficult for learner to

understand the relationships between other learners and knowledge because KA is provided by text messages.

Recently, a number of educational systems are based on WWW. Generally, educational facilities are provided within these systems and the most notable additional need reflected across all of these systems is for facilities to make the presence and action of other users available across WWW. A variety of systems are tackling this core problem in a number of different ways, e.g., WebVis (Pitkow & Bharat, 1994), WAVE (Kent & Neuss, 1994), CGV (Girardin, 1995) and Footorints (Alan & Maes, 1997). Moreover, Palfreyman and Rodden (1996) developed an open awareness protocol for WWW.

This paper proposes *Knowledge Awareness Map* (KA map) that visualizes KA information on WWW. The map helps learner to mediate and recognize collaborators in the shared knowledge space. On this map, the system identifies learning-companions who can help solving a problem. The characteristics of the map are:

(1) Visualization of the hyperlinks and categorization of pages on the Web as educational materials,
(2) Visualization of the relationships between pages and learners to induce collaboration,
(3) Recommendations of appropriate collaborators on KA map to help find suitable partners.

We are developing an open-ended collaborative learning support system, which is called *SharlokII*. SharlokII is a prototype for KA map, and facilities to share individual knowledge and to learn through collaboration on WWW pages. In this paper, first, the outline of SharlokII is described.

Knowledge Awareness Map

What is knowledge awareness?

KA is defined as awareness of the use of knowledge. In a distance-learning environment, it is very difficult for the learner to be aware of the use of other learners' knowledge because the learner cannot understand their actions in the remote site beyond Internet. KA messages inform a learner about the other learners' real-time or past-time actions: look-at, change, and discuss, that have something to do with knowledge on which a learner was or is presently engaged. For example, KA messages are "someone is changing the same knowledge that you are looking at", "someone discussed the knowledge which you have inputted." These messages make the learner aware of someone:

(1) who has the same problem or knowledge as the learner;
(2) who has a different view about the problem or knowledge; and
(3) who has potential to assist solving the problem.

Therefore, these messages that are independent of the domain, can enhance collaboration opportunities in a shared knowledge space, and make it possible to shift from solitary learning to collaborative learning in a distributed learning space.

KA messages are classified into two dimensions: time and knowledge separation. KA of type same time (ST) informs the learner that other learners are doing something at the same time that the learner is using the system. By using learners' past actions, KA of type different time (DT) provides the encounters beyond time. KA of type same knowledge (SK) is a message about other learners' activities to the same knowledge that the learner is looking at, discussing, or changing. This type is available for learners to find partners who have the same problem or knowledge. KA of type different knowledge (DK) enhances collaboration possibility with another learner (1) who has had something to do with the learner's interests; or (2) who has different expertise from the learner's interests.

For example, the message of type STSK, "Who is looking at the knowledge?" shows the existence of learners who are looking at the knowledge that the user is looking at. By this message, the user may start to discuss on the knowledge. Likewise, the message of type DTSK "Who changed the knowledge since I have last looked at?" facilitates to start discussion on the changing of the knowledge. Moreover, the message of type STDK "What knowledge are they discussing?" is useful to join into the discussion that interests the learner.

KA has a close relation with learner's curiosity. Hatano and Inagaki (1973) identified two types of curiosity; particular curiosity (PC) and extensive curiosity (EC). EC occurs when there is a desire for learning and it makes the learner's stock of knowledge well balanced by widening the learner's interests. PC is generated by the lack of sufficient knowledge, and it is very useful in that the learner can acquire detailed knowledge. KA of type SK excites PC, and KA of type DK satisfies EC. For example, a message of type STDK stirs up the

learner's EC by attracting the learner to the particular knowledge when the learner focuses on nothing. Moreover, the message of type STDK about the knowledge leads the learner to collaboration by arousing the learner's PC. In this way, KA induces collaboration by exciting the learner's curiosity.

Knowledge Awareness map

In our previous research, Sharlok presented KA information as a text message. From the text message, however, it is very difficult for learner to understand how the other learner is very interested in the knowledge. The other learner may be a vital helper who can assist the learner to understand the knowledge deeply, or may be just looking at the knowledge. Therefore, we propose *Knowledge Awareness Map* that graphically displays KA information. This map provides learner with a clear grasp of some learners around knowledge that is separated from a learner-looking knowledge. With this, the learner can seek for the learner of the discussion companion interactively.

As for the visualization of WWW space, an awareness support system (Palfreyman & Rodden, 1996) was developed in order to displays the links between WWW pages and the users who are accessing the pages into both 2D and 3D representation. This system displays the user who is only referring pages at real-time and the links of the pages. In addition to this, KA map shows the degree of learner's interests and recommends adequate collaborators.

Learner's profile

The system collects learner's profile with two techniques:

(1) The action log of learner: e.g., access times to WWW page;
(2) The explicitly registration by learner.

The actions of learner in an open-ended learning environment can be classified as follows: (A)creating a category, (B)creating knowledge, (C)making link to WWW pages, (D)asking a question, (E)answering the question, (F)modifying knowledge, (G)participate discussion, and (H)looking at knowledge. These eight actions of learner are used as one of learner's profile. However, it is difficult to detect the knowledge and the interest of the learner from learner's actions only. Therefore, it is necessary that the learner register his/her own interests on the knowledge. SharlokII realizes the registration of the interests of the learner with *footprints*. Footprint is an explicit flag that shows learner's interest to a shared knowledge.

Strategy for recommending peer learners

When learner asks a question and seeking for a helper, the system recommends one to three persons. The type of the learner who participates in collaboration is shown below:

(1) Questioner: This learner has some questions and requires collaboration.
(2) Answerer: This learner answers the question of the questioner.
(3) Participant: This learner is interested in the question and wants to join into the collaboration.

The system recommends an answerer who can help problem-solving and some participants to a questioner. The system selects a learner using the following information:

(1) The login situation of learners:
Because of real-time discussion, the system selects only loged-in users as candidates.
(2) The footprints of each learner:
Participants are selected from those who put the footprint in the knowledge (page) of the question.
(3) The profile of each learner:
Although the profile consists of the number of action times to the knowledge, the system has to evaluate totally. If the total of (A)-(D) actions of a learner is larger than that of (E)-(H) actions, then the system considers the learner as an answerer. Otherwise, the learner is a participant. The larger the total of a learner's actions, the more the learner is preferred to join into collaboration.
(4) The current action of learner:
The system gives a high priority to learners who are doing nothing (idle) in the learning environment. This consideration activates passive learners by stimulating their intellectual curiosity.

This paper proposes the level of interest (LOI) as follows:

$$LOI = \left\{F + \frac{\text{The number of the learner's actions to the page}}{\text{The max number of other learner's actions to the page}}\right\} \times \frac{1}{2}$$

Variable F shows the footprint given by learner. The value of F is 1 if leaner takes a footprint to the page, otherwise 0. The range of LOI is from 0.00 to 1.00.

Visualization of KA

A link in KA map shows the relationship between web pages and learners. The length (L) of a link means the strength of the relationship and it is calculated by the following equation:

$$L = D(2 - LOI)$$

where, D is a default value of link length.

The range of L is from D to $2D$. If a learner is very interested in a page, the link length (L) of between the page and the learner becomes short and nearing to D.

Implementation of Knowledge Awareness Map

Collaborative learning environment

Interface of the collaborative learning environment of SharlokII is shown in Figure 1. The left side shows an interface of a questioner, and the right side shows an interface of an answerer or a participant. Screen (a) is a main window of SharlokII. The learner can access to knowledge (page) in the right frame on window (a). The left frame of the window (a) shows the SharlokII functions, e.g., create WWW page, keyword search and so on. Window (b) is displayed in opening a page. The discussion is requested by clicking the "collaboration" button. Then, window (c) is shown, where the system recommends suitable collaborators for the question, and learner can also arrange other learners who the learner wants to join into the discussion. The request status is displayed on the right frame of window (a).

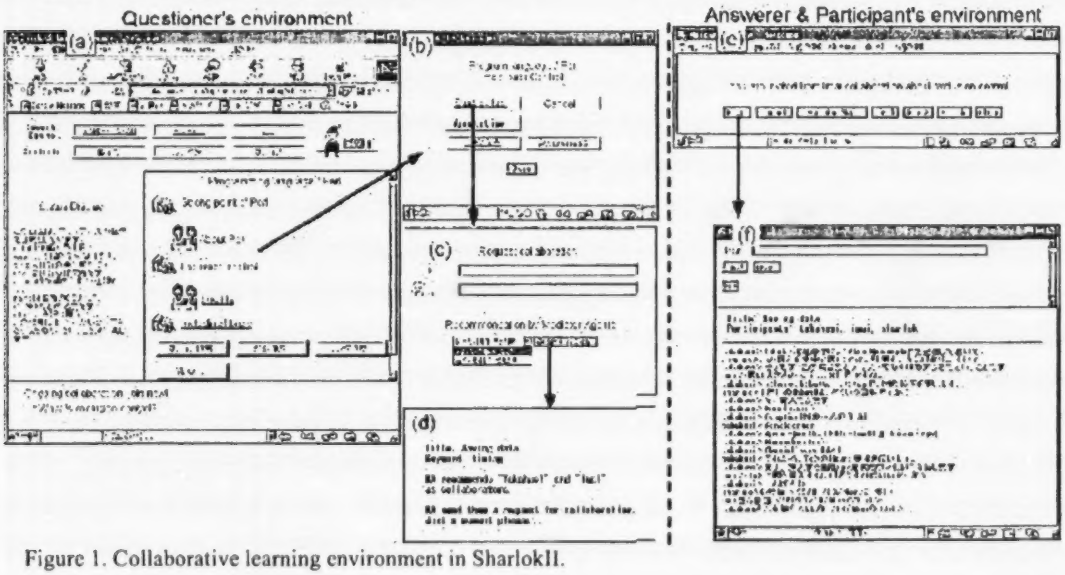

Figure 1. Collaborative learning environment in SharlokII.

Window (d) in figure 1 finally displays the candidates who the learner requests collaboration. Window (e), (f) are the screen of another learner to have required discussion. Window (e) displays an invitation message from the questioner. The message includes the questioner's names, the page title that has required to the discussion, and a knowledge name, and the title of the question. With the "OK" button on window (e), the learner accepts a

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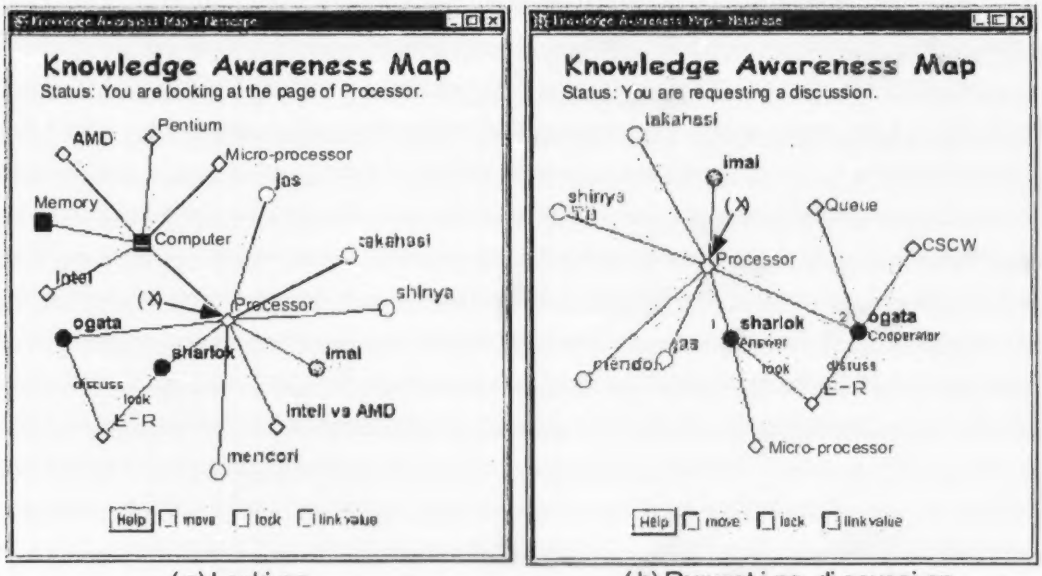
discussion request, and then the learner can participate in the discussion. In window (f) the learner can start collaboration. If the requested learner rejects the invitation, the questioner can know that in status window (a).



(a) Looking (b) Requesting discussion

Figure 2. Knowledge awareness map.

KA Map

KA map is shown in figure 2. The map is displayed in opening SharlokII. When the user "imai" is looking at page (X), window (a) is appeared. The nods of window (a) consist of categories of web pages, web pages that belong to the same category, and learners. Moreover, the system identifies learners on the map (b) into the user, a questioner, an answerer, a participant and the others when the user starts to request discussion. A close line means the learner is strongly interested in the page. When the user looks for learning companions about a topic, the user can finds peer learners who have strong interests, using this map. When the user requests a question, the user can comprehend who is an appropriate answerer through this graphical map. Moreover, when the user receives the invitation of discussion from another learner, the user can understand the backgrounds of the inviting learner. By clicking a person node, both the personal information of the learner and his/her past actions about peripheral knowledge are displayed.

Conclusions

This paper proposed KA map that supports learner to find appropriate companions for his/her problem-solving in an open-ended collaborative learning environment. To evaluate KA map, SharlokII was developed on WWW. The result of the evaluation is as the following.

(1) By the agency of the system, it is possible to discuss with the appropriate companion.
(2) With the agency support, the learner can do to do lively discussion.
(3) By the lively discussion, the contents of the discussion can be put to the learner in the impression.
(4) In to use KA map helping, it is possible to correspond in case of the analysis failure of the system.

In the future, it considers the composition of learner profile and a way of making more, it improves the analysis precision of the system and it evaluates once again.

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Modeling Goods as Agents in Electronic Business-to-Business Markets

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Abstract: In recent years, electronic commerce (EC) business has shown a tremendous growth, which put additional cognitive and time-consuming loads on the human users. Intelligent software agents are one key technology to support users doing real EC-business. We propose an Agent-based Business-to-Business (B2B) Marketplace on Internet, where the constituent members cooperate or compete in order to get the best possible deals, with the aim of reducing user loads. In case of B2B deals, the good itself shows a complicated behaviour, e.g. price discounts depending on the lot, discounts for cross-buying and so on. It is impractical to concentrate all the knowledge about the goods and the trading strategies at the buyer/seller side. Instead, we include such information in the good itself, which allow us to model the goods as being agents.

Introduction

In recent years, electronic commerce (EC) business has shown a tremendous growth, which put additional cognitive and time-consuming loads on the human users. Intelligent software agents are one key technology to support end-users as well as business doing real EC-transactions. Agents are semi-autonomous continuously running computer programs that perform some task on user's behalf. Today's first generation agent-mediated electronic commerce systems are already creating new markets (e.g. low-cost consumer-to-consumer and refurbished goods) and beginning to reduce transaction costs in a variety of business tasks. We still have a long way to go before software agents transform how business conduct business (Guttman et.al., 1998). Existing agent-based marketplaces, which mainly models Business-to-Consumer (B2C) or Customer-to-Customer (C2C) relationships, have only buyers and sellers represented as agents, interacting during the dealing process. On the other hand, the goods or items in trade show a passive behaviour.

According to the forecast, the online trading between businesses (B2B) will be much bigger than the C2C or B2C. To have an idea, Forrester Research estimates that the online trading in B2B will reach US$ 2.4 trillion by 2004. Our motivation to focus on B2B is twofold: one is based on this predicted market need and the other is that the inter-business transactions present more challenging issues for agent applications. Our claim is that in case of Business-to-Business (B2B) deals, the good itself shows a complicated behaviour, e.g. price discounts depending on the lot, discounts for cross-buying and so on. Thus, it is impractical to concentrate all the knowledge about the goods and the trading strategies at the buyer/seller side. Instead, we include such information in the good itself, which allow us to model the goods as being agents.

In this paper, we report on the marketplace model we have developed, with focus on the business flow and the interaction among the members to realize effective deals.

Trading Behaviour Stages

We can describe the trading behaviour stages in terms of the involved trading parts i.e. the buyers and sellers. From the buyers' perspective, there are several proposed models about the Consumer Buying Behavior (CBB for short), but in general they can be regarded as consisting of six stages detailed below, according to (Guttman et.al, 1998). It is important to mention that this CBB is mainly applied to the case where the buyers are "normal" i.e. not business-size, customers. We will adapt the CBB to business-size customer, which we named Business-customer Buying Behaviour (BBB for short).

(b1) need identification: the consumer becomes aware of some unsatisfied need. Within this stage, the consumer can be stimulated through product information.

(b2) product brokering: the retrieval of information to help determine *what* to buy. This encompasses the evaluation of product alternatives based on consumer-provided criteria. The result of this stage is called the "consideration set" of products.

(b3) merchant brokering: this stage combines the "consideration set" from the previous stage with merchant specific information to help determine from *whom* to buy. This includes the evaluation of merchant alternatives based on consumer-selected criteria (e.g. price, warranty, availability, delivery time, reputation, etc).

(b4) negotiation: this stage is about how to determine the terms of the transaction. Negotiation varies in duration and complexity depending on the market.

(b5) purchase and delivery: this can either signal the termination of the negotiation stage or occur sometime afterwards (in either order).

(b6) service and evaluation: this post-purchase stage involves product service, customer service, and an evaluation of the satisfaction of the overall buying experience and decision.

From the seller's perspective, the corresponding Business-size Selling Behaviour (BSB) stages which deals with each of the buyer-side BBB stages are:

(s1) advertise/promotion: to deal with (b1) need identification.

(s2) provide product information: to deal with (b2) product brokering.

(s3) provide merchant information: to deal with (b3) merchant brokering.

(s4) negotiation: to deal with (b4) negotiation, in order to determine the trading terms.

(s5) sell: to deal with (b5) purchase & delivery.

(s6) evaluation of buyer: to deal with (b6) evaluation of seller, to decide the feasibility of future deals.

The state transition graph corresponding to the buyer/seller behaviour, as well as their corresponding interactions in each BBB and BSB stages are depicted in (Fig. 1).

Agent-based B2B Architecture

Intelligent agents can assist in EC: (1) agents can go shopping for a user, taking specs and returning with recommendations of purchases which meet those specs, (2) agents can act as "salespeople" for sellers by providing product or service sales advice, (3) agents can help troubleshoot customer problems. Agent-based EC allows the creation of a virtual marketplace in which a number of semi-autonomous agents *trade goods* and support users.

In case of C2C and B2C, agents can help examining a large number of products before making a decision to buy or sell. Thus, collecting manually the product information is avoided. Another advantage of using agents is that it makes possible the negotiation for an optimal price with various sellers of a good. The buying and selling agents communicate and negotiate with each other on behalf of the human buyers and sellers.

In our case of B2B, shopping agents cannot easily compare prices, because the prices are not fixed in advance, but they are decided after the negotiation between the involved buyers and sellers. Even worse, in B2B dealings, the amount of traded goods is in terms of lots rather than a few units, so the price formation process become more complicated. The price is influenced by factors such as the lot size and cross-buying.

In general, the existing agent based marketplaces have agents representing buyers and sellers, but not the goods. Our approach is characterized for modeling also the goods as agents. In our proposal, the reason of having agents representing goods in the context of B2B transactions are:(1) there are a large number of traded goods handled by one seller in a B2B scenario, (2) the price formation strategy and other properties differs from good to good, thus (3) it would be hard to concentrate such knowledge on a single seller agent. It is rather easy to model the behaviuor of each individual good, but it becomes very complex to model the strategies concerning the set of goods

handled by a given seller agent. This is because the selling strategies not only differ from seller to seller, but there are differences even between goods handled by a single seller.

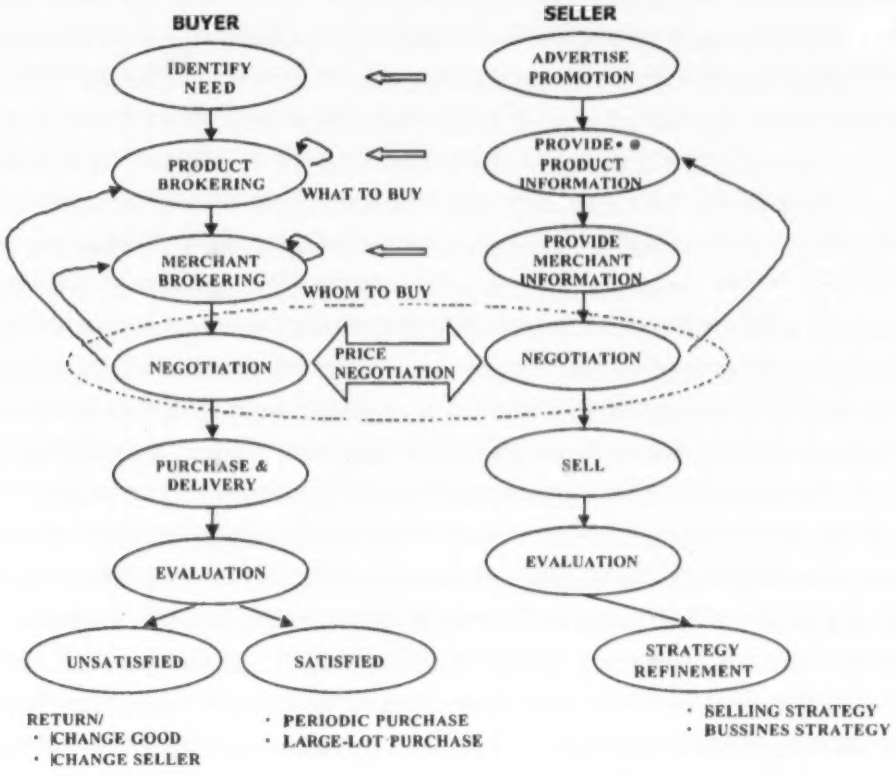

Figure 1: Buyer agent – seller agent behaviour and their interactions

In the following, we give the details of our agent-based marketplace, depicted in (Fig. 2). In our B2B agent-based marketplace model, we have three categories of agents, namely agents representing (1) the goods, (2) the dealing process, and (3) the marketplace manager.

Agent representing the goods:

(a) Good-to-buy agent. [buyer]: generated when a good which matches the buyer's need is found, and the buyer select this item by adding to his shopping cart.

(b) Good-to-sell agent [seller]: generated by the seller, to represent the item(s) that the seller is interested in selling.

Agents representing the dealing process:

(a) Search agent [buyer]: the buyer generates this agent in order to do the search on his behalf of candidate goods matching his needs.

(b) Mediator agent [marketplace]: mediate the negotiation process between the buyer and seller.

(c) Monitor agent [marketplace]: by request of buyer, monitor the marketplace for a given good.

(d) Promotion agent [seller]: generated by seller, when a promotion for a product is required.

Agents representing the marketplace manager:

Market Manager Agent [marketplace]: to control the generation, termination and other stages regarding the agents in the marketplace.

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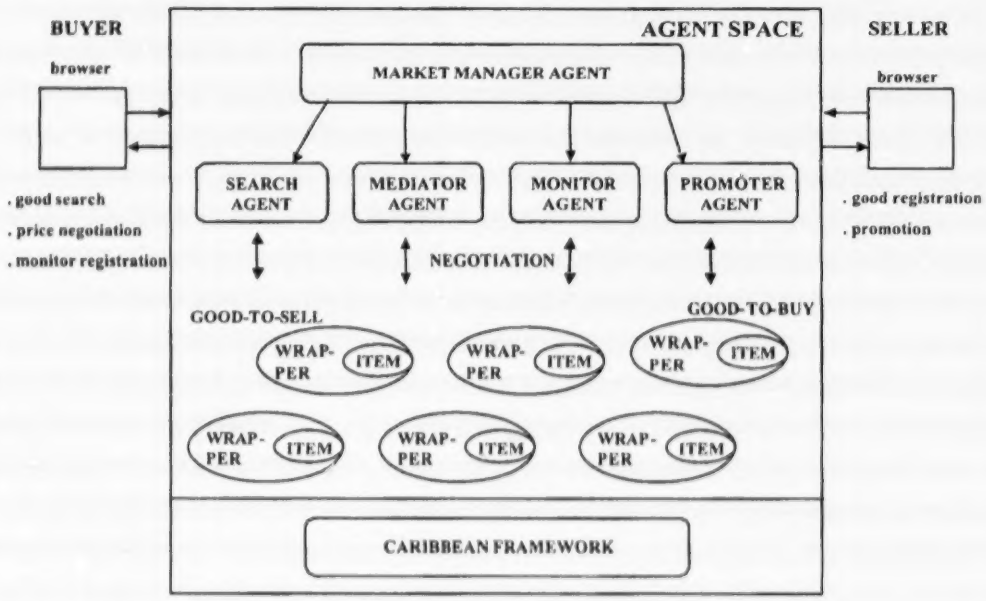

Figure 2: Our proposed agent-based B2B architecture, including the good-agents

Trading Flows and Marketing Strategies

Regarding the system design and implementation, our aim is to build a system, which reflect the real-world business dealings. In order to do so, we adapt what is called a "*mimetic strategy*" i.e. by adapting to the new IT context those traditional features that have proven effective in real-world dealing. To do so, we have conducted extensive hearings with real-world business-size traders, which were taken into account for the design of our system.

Marketing Strategies for Sells Promotion

In case of B2B transactions, one of the fundamental issues for the seller is how to promote the "repeated" sales, i.e. to get regular customers with whom to maintain a long-term relationship. To do so, we are implementing the following marketing strategies, summarized in (Tab. 1). However, the details of each strategy are not given, due to the space constraints.

STRATEGY	MISSION	ACTION
First approach (for first-time access)	- item promotion - anniversary promotion	rule 1 rule 2
Up-selling (for first-time access, repeated access)	- bundle sells - set sells	rule 3 rule ....
Cross-selling (for first-time access, repeated access)	- line discount - coordinate sells - assorted sells	.....
Second attack (for first-time access, repeated access)	- volume discount - season promotion	
Third up (for repeated access)	- relational sells	
Wake-up (for repeated access)	- sample sells	
Shut off (identified at first-time access)	- cash sells	

Table 1: Implemented marketing strategies for sells promotion

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Trading Interaction Flow

In order to give an idea of the system in action, we outline a simple interaction flow between the involved parts in the trading.

The human buyer – by interacting through his buyer agent – complete the (b1) identification need, (b2) product brokering and (b3) merchant brokering stages. The user selects the candidate goods, which satisfy his needs, by including these goods in his "shopping cart". Also, he assign priorities to the various possible criteria like: (a) ensure the desired price range, (b) ensure quality of items, (c) ensure quantity of items, (d) recommend if there are any substitute items, (e) recommend if there are any optimal combination of items. After pushing the "start negotiation" bottom, several processes start at the background, one of them being generating the goods agents corresponding to the user selected ones. The different good agents interact among them in order to propose the good's price and dealing terms satisfying the specified criteria. The user – if he is satisfied with one of the proposals – start the ordering procedure; else, he can either re-start the negotiation or quit.

Implementation Considerations

In order to have platform-independence, our system is being implemented based on Java and XML. Regarding the virtual mall development, in the current phase, we focus on the dealing of foods between businesses. For the XML, we are currently working on the definition of a DTD for food. Regarding the marketplace, we are implementing it based on Servlets to generate the different agents. We are considering putting our system on Caribbean, an agent framework from IBM.

Concluding Remarks

The amount of business on Internet is growing fast, and intelligent agents are one key technology to support users in Electronic Commerce. Existing agent-based marketplaces, which mainly models Business-to-Consumer (B2C) or Customer-to-Customer (C2C) relationships, have only buyers and sellers represented as agents, interacting during the dealing process while the goods or items in trade show a passive behaviour. However, in case of B2B deals, the good itself shows a complicated behaviour.

Thus, in this paper, we have proposed a B2B agent-based marketplace to reduce user loads, which is characterized by modeling not only the buyers and sellers, but also the goods as being agents.

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A Distance Ecological Model for Individual and Collaborative-learning support

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Abstract: Under the concept of life-long education, many people from many parts of the social environment will need to be trained and learn about IT. We have started building a framework for such people, as a distance ecological model for self/ collaborative learning support. The purpose of this study is to propose and develop a distance educational model, as a school-based curriculum development and training-system. In this environment, a teacher can learn via an Internet-based self-training system about subject contents, modern teaching know-how, and students' learning activities evaluation methods. This paper describes the structure, functions and mechanism of our distance educational model, in order to realize the above-mentioned goal, and then discuss the educational meaning of this model in consideration of the new learning ecology, which is based on multi-modality and new learning situations and forms, and we perform some tests and evaluation. Moreover, we show an extension of our RAPSODY framework, RAPSODY-EXT, which also embraces collaboration in remote learning environments.

Introduction

Recently, various new teaching subjects and methods using Internet and Multimedia are being introduced throughout the world, and in Japan in particular. Therefore, now-a-days it is extremely important for a teacher to acquire computer communication literacy (Nishinosono (1998)). So far, there were many systems developed for these purposes. In Japan, for instance, systems using communication satellites systems such as the SCS (Space Collaboration System) are developed and used as distance education systems between Japanese national universities. In the near future, a teacher's role will change from text based teaching, to facilitating, advising, consulting, and his/her role will be more that of a designer of the learning environment. Thus, teachers have to constantly acquire/learn new knowledge/methodologies. To help them in this task, we set out to build a free and flexible self-teaching individual environment for them, and at the same time, a collaborative communication environment, to support mutual deep and effective understanding among teachers, by using Internet distributed environments and multimedia technologies. In this paper, we propose a Distance Educational Model, which is based on the concept of School Based Curriculum Development and Training System, advocated by UNESCO (1998) and OECD/CERI (Center for Educational Research and Innovation), and describe the structure, function, mechanism, educational meaning of this model and finally show some preliminary system evaluation. Moreover, we show a system extension, called RAPSODY-EXT, which embraces the previous system, while adding collaboration facilities.

Distance Educational Model based on RAPSODY

The recent technological developments, e.g., the increased computational power of computers and the increased Internet bandwidth, made it possible and facilitate learning of various kinds of subject contents via a virtual school. Figure 1 shows how the material on RAPSODY is built by teachers or specialists, via our cell editing and authoring environment, and how the beneficiaries of this material can be various learners, accessing the system remotely from their working place or from their homes. Moreover, the system allows access to a multitude of individual and collaborative learning tools, like a tele-conferencing environment, supporting environments for problem solving, such as Stella, CASE, distance teaching

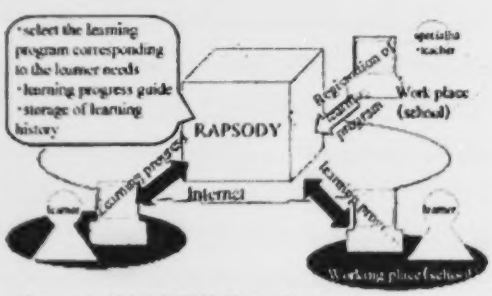
• select the learning program corresponding to the learner needs
• learning progress guide
• storage of learning history
RAPSODY
Work place (school)
Internet

Figure 1: RAPSODY Usage Image

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environments, such as Tele-Teaching, and so on.

Our Distance Educational Model is built on three dimensions (figure 2): the subject-contents unit, the teaching knowledge or skills, and the favorite learning media (e. g., VOD, CBR (Case Based Reasoning), etc.). By selecting a position on each of the three axes, a certain CELL is determined. A CELL consists of several slots, which represent the features/characteristics o f the Learning Object. The meaning of each axis will be explained in more details.

Subject –contents unit

Subject-contents unit represents what the teachers want to learn. In our case, the subject is called "Information", established as a new obligatory subject in the regular courses of the academic high school system in Japan; it is divided into the following three sub-subjects:

Information A: Raising the fundamental skills and abilities to collect, process and transmit "information" using computers, Internet and Multimedia.

Information B: Understanding the fundamental scientific aspects and the practical usage methods of "information".

Information C: Fostering the desirable and sound behavior regarding participation, involvement and contribution in an information society. This sub-subject focuses on understanding peoples' roles and the influence and impact of technology, in the new information society.

Teaching knowledge/skills

Teaching knowledge/skills is defined as: sub-subject contents, teaching and evaluating methods. Among them, 'teaching methods' stands for how to use and apply IT, which involves comprehensive learning activities, such as problem recognition, investigation and analysis, planning and design, implementation and executing, evaluation, report and presentation. We aim at teachers' acquiring the proper students' achievements evaluating skills, according to each of the above activities.

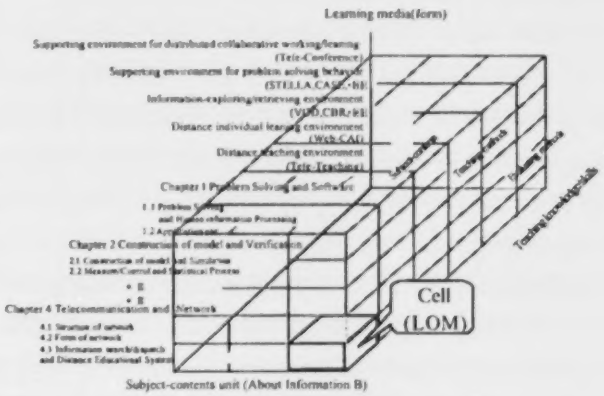

Figure 2: Structure of the Distance Educational Model

Learning media (form)

This dimension represents five different learning environments, as follows.

(1) **Distance teaching environment (Tele-Teaching):** This environment delivers the instructor's lecture image and voice information via Internet, by using the VOD real-time information dispatching function.

(2) **Distance individual learning environment (Web-CAI)**: This environment provides CAI courseware with WWW facilities on the Internet.

(3) **Information-exploring and retrieving environment**: This environment delivers, according to the teacher's demand, the instructor's lecture image and voice information, which was previously stored on the VOD server. For delivery, the function of dispatching information accumulated on the VOD server is used. This environment also provides a CBR system with classroom teaching practices short movies.

(4) **Supporting environment for problem solving:** This environment provides a tool library for performance support, based on CAD, Modeling tools, Spreadsheets, Authoring tools, and others.

(5) **Supporting environment for distributed collaborative working & learning:** This environment provides a groupware with a shared memory window, with text, voice and image information for the trainees.

"Cell" Definition

Table 1: The Frame Representation of the "Cell"

	Frame-name:	*Slot-value*
Slot-name	Learning objectives for a student	Subjects which should be understood / Subjects which should be mastered
	Subject-contents	The unit topic
	Teaching method	The students ' supervision method and instructional strategies
	Evaluating method	The students ' evaluation method
	Useful tools	The software used for the training activity
	Operational manual of tools	The software operation method used for the training activity
	Prepared media	The learning media which can be selected

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Guide script	The file which specifies the dialog between the trainee and the system

The concept of a "cell" in the Distance Educational Model is quite important, because it generates the training scenario (including information according to the teacher's needs), the subject materials learning-flow and the guidelines for self-learning navigation. The frame representation of the "cell" is shown in Table 1. These slots are used when the system guides the process of the teacher's self-learning.

Outline of the Teacher Training System

The teacher's training environment system configuration is composed of two Distance Education subsystems. One is the training system; the other one is an authoring system with "cell" description creation and editing functions. Details follow in the subsections.

The Training System

The training system aims to support teachers' self-training (figure 3). The role of this system is first to identify a "cell" in the model, according to the teachers' needs, and then, to set up an effective learning environment, by retrieving the proper materials for the teacher, along with the "guide script" defined in the corresponding "cell". Therefore, the system offers programs for both Retrieving and Interpreting. The training system working steps are:

STEP 1: Record the teacher's needs.
STEP 2: Select a "cell" in the Distance Education Model according to the teacher's needs.
STEP 3: Interpret the "cell" in the guide WM (Working Memory).
STEP 4: Develop the interactive training with the teacher according to the "guide script" in the guide WM.
STEP 5: Store the dialog log-data. The log-data collects information on the learning histories and teachers' needs and behaviors.
STEP 6: Provide the needed and useful applications for the user's learning activities and set up an effective training environment.
STEP 7: Give guidance-information, according to the "cell" script guidelines, and decide on the proper "cell" for the next learning step.

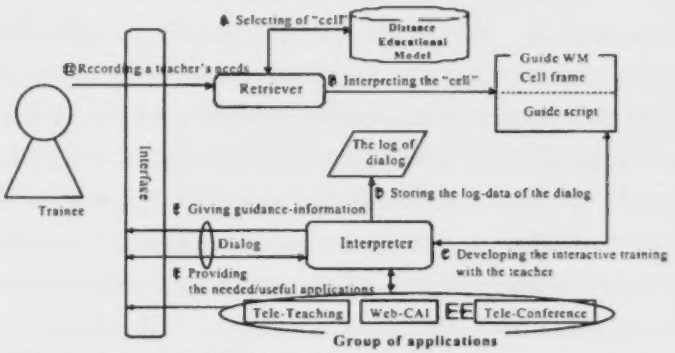

Figure 3: Configuration of Training System

Here, it is necessary to explain the dialog mechanism (algorithm) between user and system. The interpreter controls and develops the dialog process between user and machine according to the information defined in our "guide script" description language (GSDL), consisting of some tags and a simple grammar for interpreting a document, similar to the HTML on the WWW. The interpreter understands the meanings of the tags, and interprets the contents. An example of GSDL is shown below.

(1)<free> Definition: description of the text (instruction)
(2)<slot (num.)> Definition: a link to a slot value in the "cell"
(3)<question> Definition: questions to a trainee
(4)<choice> Definition: branching control according to a trainee's response
(5)<exe> Call: to relevant "cells"
(6)<app> Definition: applications used for training activities (e.g., Tele-Teaching, etc.)

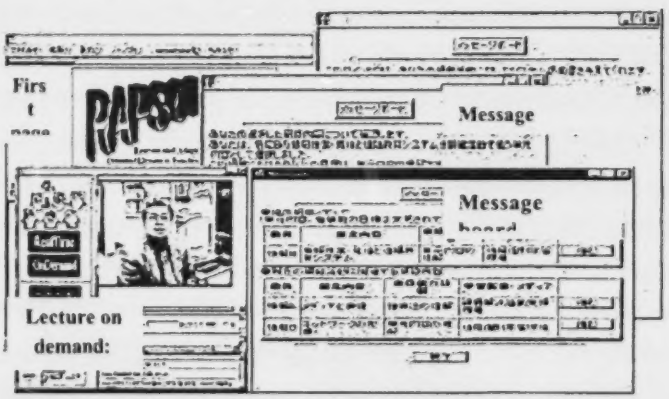

Figure 4: Training System Window Interaction: first page, message windows, lecture video, message board

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Authoring System for Creating and Editing a "Cell" Description

The system (see, figure 5) provides an authoring module to create and edit the information in the "cell". This module also offers the function of adding new cells, in order to allow supervisors (experienced teachers) to design the teachers' training program. This system is composed of the cell frame creating module, and the "guide script"-creating creating module. A cell design is shown as follows.

STEP 1: Get the "cell" slot-values: "student's learning objectives", "subject-contents/teaching/evaluating method", and " useful tools".

STEP 2: Substitute the return value of the slot of the prepared media with the training-contents corresponding to the user's needs.

STEP 3: Substitute the slot -value in the "cell" for the corresponding tag in the "guide script" template.

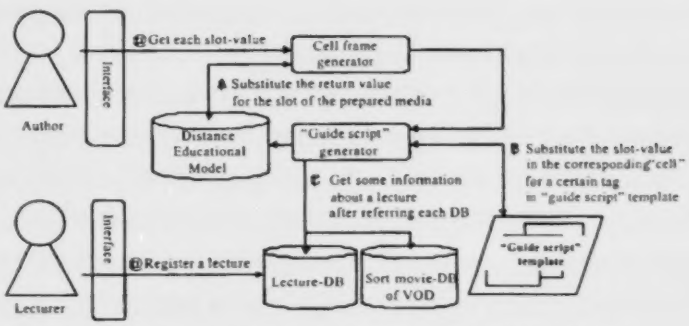
Author
Interface
Get each slot-value
Cell frame generator
Substitute the return value for the slot of the prepared media
Distance Educational Model
"Guide script" generator
Substitute the slot-value in the corresponding"cell" for a certain tag in "guide script" template
Get some information about a lecture after referring each DB
"Guide script" template
Lecturer
Interface
Register a lecture
Lecture-DB
Sort movie-DB of VOD

Figure 5: The Procedure of "Cell" Description for Creating/Editing of the Authoring System

STEP 4: If "Tele-Teaching' is selected, get information about the lecture, by referring the lecture- and VOD short movie-DB.

STEP 5: Add the new "cell" to the Distance Educational Model.

The lecture-database consists of "lesson managing files" containing user-profile data, lecture schedules, trainees learning records, lecture abstracts, and so on. The "guide script" template file contains tag-information, written in the "guide script" description language (GSDL), for all subject-contents items in the Distance Educational Model.

Evaluations and Tests

To inspect the usefulness of our system, we carried out some evaluation experiments. Subjects/ testees were future teaching staff, training in universities, as well as already presently enrolled teaching staff, undergraduate students, and finally, people just interested in information education. From the point of view of practical usage of the system.our goal was to provide the user with a "school" in the actual spot where the teacher/user is .be it workplace or home, and allow access via the various existing network environments. The system usage form can be classified therefore as:

a) Computer connected via a relatively high-speed network	at a university or at a workplace institution;
b) Computer connected via a low speed network	at the workplace or at home. In the latter case.the system has to be able to prove enough practical use even for the low speed net.

The evaluation of our system can be conducted from two points of view:

a) Educational effect of the staff training
b) System operationality & functions; next we will report the evaluation experiments results concerning this point.

We performed an experiment involving as testees 19 teaching staff members and 14 undergraduate students. We classified the testees according to the network speed of the used environment into:

home (modem.	home.ISDN.	workplace (modem)	workplace(ISDN)	workplace/university (LAN)
5 people	4 people	0 people	16 people	8people

The testees had to use the system for a minimum of 2 hours to perform self-training. Moreover, we set up the following experimental conditions for the separate training and designing sessions:

(1) The testees with specific interests about some information items would select the training program according to those interests, and then proceed with their training. The testees with no clear goal . would select the "communication and networks" training program and then proceed with their training.
(2) The testees had to implement also at least 3 training programs, by using the cell construction & editing system.

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Before enacting the experiment, the distance education modem database contained already 37 training programs. After more than 2 hours system usage, the testees were asked to fill in a questionnaire that contained 34 questions, organized according to points of view of such as "easiness; convenience "."functions" and "computer environment". Except for questions related to the "computer environment", evaluation was performed on a linear scale of 0 to 5 points. In the following.the questionnaire result is presented and analyzed.

Firstly, we will present the results regarding the self-training system. The average evaluation results for the questions "*Did you manage to select a training program that contained novelties for yourself?*", "*Were the message number and contents displayed in the message window and the indication methods appropriate?*" was 3. 7, so high. However, the evaluation results of the questions "*Was the number of training programs(candidates) for the next step training activity in the training program list sufficient?*" were 3. 2, so relatively low. Moreover.the response dispersion of 0. 17 was.compared to the dispersion of other questions.0. 006~0. 1., high. We think that it is possible to improve this by having more candidate inputs for each training program, and implementing improved training program lists.

Next.we will present the results according to the cell construction/editing system. The evaluation regarding the question "*By using the connection/ relation editor, did you manage to design links well?*" had an average of 3. 5, so was highly evaluated. However, the question "*Did you manage to build scenarios well by using the Guide-Script Editor?*" was evaluated with a low average of 2.9. This is due to the fact that the context types defined in the Guide-Script editor were not enough. Moreover, many testees have answered that it was difficult to construct with the editor, as the contexts available for composing scenarios were only 6, and there were many constrains. Therefore, it is necessary to re-analyze the context types. We are currently investigating a description method that allows more degrees of freedom and more available contexts. We have prepared also 4 questions regarding the item "Computer". The global evaluation resulting from all questions had an average of 3. 5, so was relatively high and promising.

RAPSODY-EXT: Collaborative Learning Environment Extension

The main collaborative learning extensions of RAPSODY-EXT over the previous RAPSODY system include: (1) basic equipment of Synchronous /Asynchronous collaborative learning, (2) Synchronous /Asynchronous collaborative learning materials development facilities, and (3) Synchronous /Asynchronous collaborative learning support function supplement.

The extension of RAPSODY-EXT over RAPSODY can be seen in figure 6. The most important are the collaboration learning support tools, that have to do goal oriented work path planning, to select the tool(s) offering the common working environment, to function as a work history registration/ administration tool, and finally, to do manage results. In this way, RAPSODY-EXT becomes a remote and adaptive educational environment and, at the same time, a dynamic communicative system for collaborative learning and WWW synchronous and asynchronous collaborative learning support. Therefore, the RAPSODY-EXT extended system also features: (1) Synchronous or asynchronous collaborative learning group - or individual portfolio construction, (2) Collaborative activity logging in the collaborative memory, (3) Portfolio and collaborative memory knowledge management, and (4) Offer of various directory information

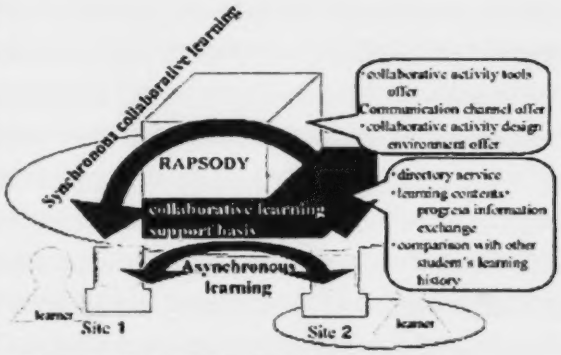

Figure 6: Collaborative Learning environment

We base many of our management function implementations on one of the strongest tools in collaborative environments, agent technology, which we have not gone into details about in the current paper. Beside of performing low-level management functions and communication functions, agents can build user models, infer interpretations, simulate students or teachers in the collaborative environment, therefore implying different levels of intelligent processing (Dillenbourg, 1999).

Group and Individual Portfolio Construction

Depending on the collaborative learning style (synchronous/ asynchronous), an individual/ group portfolio is created as a collection of log data about important collaborative activities. Concretely, the following mechanisms are offered: communication message management and knowledge management. The communication management

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function is software acting at a higher level than the learner computer terminal and the collaborative learning management server. Depending on the learner's terminal, the learner data for communication is collected from public and shared applications, is grouped according to the communication message type (data development time stamp, learner ID, message attribute, shared application operation data, etc.) and sent to the collaborative learning management server. On the server, the communication message received from the learner computer terminal is handed over to the knowledge management mechanism. This mechanism does a structure analysis of the message received from the communication message management mechanism, and arranges and integrates the new data with the already accumulated data available in the collaboration learning management database.

Knowledge Management of Collaborative Learning Data

The main goals of the knowledge management in RAPSODY-EXT are to link the information stored in the Collaborative memory to reflect each learning stage. We distinguish between the following two main categories: *Text information management*, as in, for instance, concept information extraction: extracted concept dictionary, "on the fly" dictionary; data mining process: computational (frequency, mutual frequency), conceptual (topic/viewpoint, etc.); information visualization: task dependent (word processor, task viewer, etc.), task independent (SOM, state diagram, etc.). *Non-textual information management*, as in the mining process via information gain machine learning methods: ID3 (C4.5), decision trees; information visualization: NN usage: SOM, Symbolic "map" generation.

Conclusions and Discussion

This paper proposes a Distance Educational Model called RAPSODY that stands for the networked virtual learning environment based on a three dimensional representation, with the axes 1) subject-contents, e.g., "information", 2) teaching knowledge and evaluation methods and 3) learning and teaching media (forms). This represents a new framework for teachers' education in the coming networked age. We have shown the system rationale and explained the architecture of the 3D-representation model training system. Furthermore, we have described a "guide script" language for cell building. Some of the cell contents design represents the research of other Doctoral students and researchers in our laboratory, and was presented at different other international conferences. For instance, a VOD system for classroom teaching video retrieval is being built, for providing teachers with several examples of teaching practice, classified from different points of view and focusing on different aspects of the teaching process. Another example is a CBR system for teachers. Another line of research involves CAI systems, as, e.g., an individualized system for self-training and upgrading in the Neural Networks domain, and an agent-based adaptive system for academic English teaching. The main aim of our system is to support teachers' self-learning, provided as in-service training. At the same time, we need to build rich databases by accumulating various kinds of teaching expertise. In this way, the "knowledge-sharing" and "knowledge-reusing" concepts will be implemented. With this system, we can construct various kinds of learning forms and design interactive and collaborative activities among learners. Such an interactive learning environment can provide externalized knowledge-acquisition and knowledge-sharing, via the communication process, and support learning methods such as "Learning by asking", "Learning by showing", "Learning by Observing", "Learning by Exploring" and so on. Among the learning effects expected from this system, we also aim at meta-cognition and distributed cognition, such as reflective thinking and self-monitoring. Therefore, through this system we expect to build a new learning ecology. Finally, we made preliminary functionality tests with the actually implemented system, which have shown us some of the current strengths and weaknesses of the system, and pointed to the future developing directions. For future research, we have to evaluate the system's effectiveness and usability as a whole from educational point of view.

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The Professorate in the Context of Distance Learning Environments

Carol Oliver, The Graduate School/ The City University of New York, USA

This demonstration will illustrate preliminary data from survey research of faculty who teach online in a community college in upstate New York. The results of this preliminary data will illustrate professors' everyday work experiences teaching courses online, their work responsibilities as faculty within the larger university system and the issues that affect these faculty members when they teach online. This presentation will show how these experiences have an effect on their professional work environment and their professional work experiences when using distance learning technologies. Presentation will illustrated a summary of the preliminary data.

Wireless laptop networking in the classroom:
A brief history, some practical issues, and areas for future research
Leslie Opp-Beckman, University of Oregon

What do Starbucks (Brewin, 2001), the Viking warrior king "Bluetooth" (Bluetooth, 2001), and international students at our local University of Oregon's American English Institute all have in common? They have caught the wireless wave, a "wired" (online) but "untethered" (cable-free) version of surfing the Web and interfacing with the Internet. Starbucks will put wireless networking in its coffee shops starting this spring, Bluetooth has lent his name to a fast-growing, start-up wireless endeavor, and our department is just trying to stay abreast of all the change. "Is it magic?[1]" and "In a short time, I expect we might feel the same way when we think back to the days when we actually used wires to connect our computers. For I have discovered the luxury of a wireless LAN (WLAN) (Wright, 2000)" are typical responses to the cordless computing experience. All hype aside, this paper gives a brief history of radio frequency (RF) wireless communication/computing, looks at some practical issues around setting up wireless laptop computers and incorporating them in an educational setting, and offers some food for thought on areas for future research. The content of this paper is based on a combination of a literature review and my own hands-on experience with setting up a pilot wireless mobile lab for the University of Oregon's American English Institute. Although there is occasional reference to specific equipment, this paper in no way endorses any particular product or company over another.

A brief History of Radio Frequency (RF) Wireless Communication/Computing

To get the notion of wireless computers straight in my own mind, I started by asking how humans have gone from semaphores and hilltops to iBooks and laptops. The chronological chart that follows, a collection of dates drawn from others' work (Codispoti, 1999; Jones, 2000; Champness, 2001; Johns Hopkins School of Public Health, 2001; Cable and Wireless, 2001; Shea, 2001) and by no means comprehensive, points to some key events in the ongoing development of the "loosely coupled" technologies surrounding wireless radio frequency-based communication. While relevant, histories of developments in other related areas that have fed into the development of wireless communication and networking such as electricity, conductors and metals, glass and fiber optics, non-cellular telephony, cabling, and computers are not detailed in the chart or in this particular paper. The issues and properties of other wireless models such as infrared (IR) wireless optical technology (Pennsylvania State University, 2001) are also not part of this discussion since they were not viable options for our educational setting.

1790's	French engineer Claude Chappe invents "optical telegraph:" a series of semaphores mounted on towers, where human operators relayed messages from one tower to the next.
1864	Trans-Atlantic telegraph with copper cable is established.
1867	Maxwell predicts existence of electromagnetic (EM) waves.
1887	Hertz proves existence of EM waves; first spark transmitter generates a spark in a receiver several meters away.
1894-1897	Gugliemo Marconi, "father of radio," experiments with radio waves (Hertzian Waves), obtains patent, and establishes the fist radio factory in the world in England: the Wireless Telegraph and Signal Company, Ltd.
1898	Wireless telegraphic connection between England and France is established.
1901	Radio signals are transmitted across the Atlantic from Cornwell, England to Newfoundland, Canada.
1905	First wireless distress signal is sent using Morse Code.
1914	First voice over radio transmission is sent.
1920's	Radio-based mobile receivers are installed in police cars in Detroit. (Transmitters follow a decade later.)
1927	Wireless radio-based communication services have been established between countries such as England, Canada, United States, Australia, South Africa and India.
1929	Marconi's wireless service combines with copper cable-based telegraph services to

[1] A question I have heard several times from students accessing the Web with a high speed connection on a wireless laptop.

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	form the Imperial and International Communications company.
World War II	Wireless encryption is developed by the military.
1949	U.S. FCC recognizes mobile radio as new class of service.
1971	ALOHANET at University of Hawaii constructs first wireless Local Area Network (LAN).
1978	Two thousand Illinois Bell Telephone customers in Chicago test the first mobile phones operating on a radio frequency cellular system.
1979	NTT/Japan deploys a radio-based cellular communication system.
1991	US Digital Cellular phone system is introduced.
1997	IEEE ratifies 802.11 wireless radio frequency standard for local and personal area computer networks.
April 1999	Morse Code retired from use.
Sept. 1999	IEEE ratifies revised 802.11b (high rate) wireless radio frequency standard for local and personal area computer networks.
1999-present	Bluetooth(Bluetooth, 2001), HomeRF, 3Com, Cisco, Lucent and others compete to develop products to support seamless wireless radio-based networking of computers, peripherals, cellular phones, PDA's, etc.

A series of patterns are evident in the above inventions and events, and reveal an ongoing:

- Convergence and overlay of technologies; for example, combining telegraph cables with RF wireless communication, and combining fiber optic cables with RF wireless communication.
- Desire to move from bound to untethered equipment for communication with other humans and machines: for example, from a semaphore tower that people have to stay in in order transmit/receive communications, to the use of smaller and smaller devices (telegraphs, phones, PDA's, lightweight computer laptops) that people can carry around with them in order to transmit/receive communications.
- Increase in speed and quality of the transmission (communication).
- Proliferation in and refinement of the equipment that supports the transmission (communication): for example, the accuracy of Moore's Law (Intel, 2001; Moore, 2001) which has successfully predicted that each new computer chip will contain roughly twice as much capacity as its predecessor, and each chip will be released within 18-24 months of the previous chip. Recent innovations in transistors could keep Moore's Law in force until 2025, or beyond. By that time, scientists hope to have developed entirely new technologies to replace integrated circuits made from silicon (Venere, 2001).

Wireless communication and computing clearly seems here to stay (Schwartz, 2000), whether embedded in your laptop (3Com Corporation, 2000), fixed from a building top (Martinez, 1999), or routed through a chip in your cellular phone (Romero, 2000; Page, 2000; Bluetooth, 2001; ARC Group, 2000). Controversies surrounding RF-based wireless networking abound. One hotly debated issue surrounds the potential for interference between short-range Wireless Personal Area Network (WPAN) devices such as cell phones with wireless chips, and longer range Wireless Local Area Network (WLAN) devices such as a network of computers with wireless chips, all using the 802.11b standard. Initial research seems to show that the WPAN's and WLAN's can co-exist peacefully in the same environment for now (Hibbard, 2000; Zyren, 1999). A second controversy concerns the potential health dangers of being bombarded with radio waves. So far, however, nothing definitive points to any health dangers (Clarke, 1998; World Health Organization (WHO), 2000; Bernatchez, 2001).

The wireless laptop computers described in the project in the next section all use chips and antennae embedded in the laptop computers coupled with access points on T1 connections that conform to the 802.11b standard. Some access points are wall-mounted and some are portable (more on this in the following section). For more information on how this type of wireless network operates, see:

IEEE 802.11b Wireless LANs, Wireless Freedom at Ethernet Speeds (3Com Corporation, 2000)
http://www.3com.com/technology/tech_net/white_papers/503072.html

IEEE 802.11 Tutorial (Petrick & Zyren, 2001)
http://www.wi-fi.net/downloads/IEEE_80211_Primer.pdf

Wireless LAN Association (WLANA) (Wireless LAN Association (WLANA), 2001)
http://www.wlana.org/

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Wireless Ethernet Compatibility Alliance (Wireless Ethernet Compatability Alliance, 2001)
http://www.wirelessethernet.org/

Setting up a Pilot Wireless Mobile Lab

Students at the American English Institute (AEI) study English as their second (or third or fourth) language in order to prepare for academic studies in U.S. colleges and universities. Like all other students at the University of Oregon (UO), AEI students pay a "educational technology" fee each term that supports the campus' networking infrastructure and general use labs. There is a small pool of money from this fee that is available for use by departments with innovative ideas. Fall 1999, about the time the 802.11b standard really solidified, UO was testing wireless networking in public spaces on campus. At that time, AEI also submitted a proposal to the Educational Technology committee for a Mobile Wireless Lab that could be used in an classroom setting. In short, we said we would provide the cart, software, training and technological support for the laptops if the Educational Technology committee would fund the purchase of a start-up set of laptops for use with students in our classes. We spread the purchase of the requested laptops out over a three-year period to allow for periodic evaluation of the project as an experimental "pilot" and to phase in the acquisition of the laptops in such a way that we could afford to replace one third of them each year in the future, instead of all of them at the same time:

Phase	Academic Year[2]	Results
I	1999-2000	Granted five laptops; purchased five additional laptops for faculty use. Also purchased 20-unit cart, 3 wall-mounted access points[3], and 1 mobile wireless hub[4].
II	2000-2001	Granted an additional five laptops; purchased two additional laptops for faculty use. Will install 3 more wall-mounted access points in classrooms in a different building.
III	2001-2002	Request submitted; decision pending.

As the chart above indicates, we exceeded our original purchasing plans. The laptops have been very popular with faculty and our existing laptops for faculty check out were out of date, so we replaced them with the same model of wireless laptops. They are housed as part of the mobile lab and go out into the classrooms alongside those purchased with student educational technology fees. The department can "double dip" on the use of part the laptops, using the laptops purchased with general funds both for students and for faculty. The remainder of this section of the paper will cover issues related to the why's and wherefore's of our wireless mobile lab, the implementation of our plan including, training, maintenance, and security, an overall cost analysis and some observations.

To begin with, why develop a mobile wireless mobile lab at all? Though the issue of whether or not computers absolutely make a difference in the classroom may not be 100% settled for all educational settings, in the context of our students' learning environment, it's pretty clear that computers and computer literacy are necessary. When students leave our program, at a minimum they need to be able to word process their writing (keyboarding is handy for this, too), communicate appropriately through email, use electronic databases and a Web environment to conduct research, and manage their digital files and resources (save, back up, organize, etc.). We also offer computer-based forms of independent study while in our program with grammar, reading and TOEFL test practice software, a growing Virtual

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[2] The academic year in the United States starts in the fall (the end of September for UO) and finishes in the spring (mid-June for UO). UO is on the quarter term system.

[3] The original access were WaveLAN's from Lucent. UO's Network Services division is now testing the newer generation of access points and may user another model and distributor. As always, they work equally well with both PC's and Mac's and will be backwardly compatible with existing wireless laptops.

[4] The airport from Apple.

Language Lab with streaming audio files[5], and elective mini-courses that cover topics such as the basics of web authoring, working with images, and creating a resume. The use of video, audio and computer-based multi-media materials has long been incorporated throughout our curriculum. In the case of computers, however, their presence has been less than "ubiquitous" when students have had to leave their classes, go to a centralized lab at a pre-arranged time, sit at a cubicle and make the most of their slotted computer lab time at the lab's (rather than the student's or faculty's) convenience.

The need for more access to computers in our classes has steadily increased but the availability of labs in general and even rooms and buildings in which to house labs has not. Our classes were competing with other classes for the use of lab time, but we did not have the dedicated space or funds to develop and support a full-blown traditional "lab" of our own. We needed more flexibility in access to and use of our computing resources. At the same time, we didn't have any "extra" money to hire another Information Technology (IT) specialist to support additional computers.

The solution seemed to be to develop a mobile lab that could be moved around to classrooms, as needed. With the advent and institutional support of 802.11b RF wireless capability, there seemed no reason to tie ourselves down to a room any more. We envisioned faculty carrying "pods" of about four computers at a time for small group or "stations" style classroom work, or wheeling a larger batch of laptops into class for individual or pair work. In the case of special short-term programs with 20-25 participants, always an awkward number for the typical 20-station lab with one or two computers inevitably "frozen," we planned on pulling a handful of wireless laptops in to the traditional lab to supplement as needed. In this way we could avoid splitting the class into two groups (and paying for an additional instructor). To cut down on support time and costs, we implemented pro-active policies that we hoped would avoid lengthy trouble-shooting and maintenance problems.

Other educator-enthusiasts have noted wireless "a la cart" benefits such as freedom of organization in and out of the classroom, transparent connection to nets, and better realization of "anywhere, anytime," in fact a shift from "anywhere, anytime" to "everywhere, everytime" (Berger, 2001). What then has worked so far for us, what has come as a surprise, and what has fallen by the wayside?

We can partially gage success by looking at anecdotal feedback and factors such as:

- *Patterns of use in classrooms.*
  Faculty still use dedicated labs, especially for writing courses. The wireless laptops get checked out most often in groups of 2-6 computers for in-class use in a broad range of courses and settings. They were invaluable during the summer with our short term groups of 25 and expanded the general use labs in just the way we had planned. Students ask faculty to bring them to class for use during structured class activities and free moments.

- *Patterns of use by faculty outside of class.*
  In and out of the class, the 25-30% faculty who are already very comfortable with computers are thrilled with the wireless laptops. I have to pry them back out of their hands. Likewise, the 10-15% of faculty who are still not at all comfortable with computers avoid or minimally use the wireless laptops just as they do other computers. It is the 50-60% of the rest of the faculty that falls somewhere in the middle that is the most interesting. Based on usage patterns and anecdotal feedback, they are generally much happier with the streamlined wireless laptops than with other laptops we've had or with "new" computers in general use labs. For example, faculty report that the wireless laptops are "cute" (like pets?), there are fewer "holes" to worry about sticking the wrong cable or cord into, they easily fold open and shut and take up little space in the classroom, they are easy to check out and carry, their systems and folders are locked down so that users can't accidentally "hurt" or "break" them). Feeling comfortable and confident with the computers and feeling that they blend seamlessly into the class environment are obviously important factors.

- *Amount of time and money spent on repairs and maintenance.*
  Even with the purchase of a high-quality cart[6], we have saved a considerable amount of money compared to establishing a stationary, room-based lab. Laptop users are not permitted to load software of any kind on the computers. Users have access to temporary storage and a set number of applications only[7]. Laptop users are also not permitted to permanently store backed up files on the laptops; all users have easy access

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[5] See the UO Yamada Language Lab web site http://babel.uoregon.edu/ for more information on the Virtual Language Lab.

[6] Over $1,000 even with the educational discount. After much shopping around, purchased from Anthro http://anthro.com/ and made especially for the iBook laptops from Apple that we have.

[7] We are using Mac OS 9x multi-user function to control access.

to one or more back up servers and a USB floppy or disk drive. Norton Anti-Virus self-updates and regularly scans files for viruses. In the event an application or OS becomes corrupt, no attempt is made to repair it. The hard drive is wiped clean and a new set of files is loaded on via the network (a full back up of all applications and system files is stored on an independent drive). As planned, this set of policies and procedures has reduced the amount of time needed for maintenance and repairs. "Training" of students has been non-existent, and a 15-20 minute orientation for faculty, individually or in very small groups at check-out time, has worked well.

Surprises can come in many guises. In addition to the above successes that we hoped for, we have been *pleasantly* surprised in many ways. Students have been very receptive to the laptops and have come up with ideas for using the laptops that had not occurred to faculty: for example, taking their process writing-style in-class "exams" on laptops instead of with paper and pencil in order to make editing and corrections easier. Also on a pleasant note, none of the laptops (knock on wood) have been stolen, always a big worry with expensive, portable equipment[8]. In addition, we have been approached on a regular basis by other departments on campus and by other institutions about borrowing or discussing the wireless computers. This has been a beneficial way of "networking" with other colleagues and programs.

We were *unpleasantly* surprised to get a $400 bill for repairs to a laptop that got a not-so-hard bump in an unfortunate spot (right on the modem and ethernet ports on the side corner of the case). As would be the case with the majority of laptops, the whole case had to be replaced. This kind of "abuse" is unfortunately not covered by the warranty. This, combined with the fact that some faculty still find them too heavy to carry (especially four or more at a time), prompted us to also invest in smaller, well-padded carts on wheels that hold about four laptops at a time.

If anything has so far fallen by the wayside, it is the thought that the wireless laptops were ever anything "temporary" or "pilot." I can not conceive of ever investing in a cubicle-style lab with lashed down computers again. I can not imagine that, once they become steadfastly accustomed to working in an untethered and ubiquitous computing environment, our students will settle for anything less. They are often what drive reluctant faculty to make pro-digital changes. For more on Teaching English to Speakers of Other Languages (TESOL) and Computer-Assisted Language Learning (CALL in particular), see:

CALL Environments: Research, Practice and Critical Issues (Egbert & Hanson-Smith, 1999)

"Computers and language learning: An overview" (Healey & Warschauer, 1998)
http://www.gse.uci.edu/markw/overview.html

Multimedia CALL: Lessons to be learned from research on instructed SLA (Chapelle, 1998)
http://llt.msu.edu/vol2num1/article1/

CALL in the year 2000: Still in search of research paradigms? (Chapelle, 1997)
http://polyglot.cal.msu.edu/llt/vol1num1/chapelle/default.html

The Power of CALL (Pennington, 1996)

Food for Thought and Areas for Future Research

Terms, just recently held to be futuristic, seem suddenly in our midst and part of our every day vocabulary. Futurologists and trend-predictors have been forecasting the "rise of network society" (Castells, 1996), a post-industrial era of "Third Wave" technology and lifestyle (Toffler, 1980), and the development of complex and ever-expanding digital communities and interactive environments in a new "Information Age" (Negroponte, 1995). Other voices warn against " overreliance on information" (Brown & Duguid, Nov/Dec2000) or paint pictures of darker, less humane and less-connected versions of cyberworlds, as in Snow Crash (Stephenson, 2000). The growing numbers of educational endeavors around the world using virtual and distance education (Farrell, 1999), the explosion of distributed computing a.k.a. peer-to-peer (or P2P) computing in business and educational domains (Malik, 2000), and the acknowledged benefits and increasing pervasiveness of wireless technology (Kurzweil et al., 2000) bring the future into the present in

[8] The Apple sales representative, Mark Johnson, told us to take a big, ugly permanent marker and deface the outside covers of the laptops with our departmental name and contact information in order to make them unattractive to would-be thieves. We're not sure how much of a deterrent it's actually been, but it certainly has made them ugly and gotten us some strange looks when we whip them out at airport business centers.

education. The importance of both technology and multi-lingualism in education and in the world at large as a concept (if not a practice) also seems to be gaining increasing acceptance (Rogers, 2000). For those of us working in the combined areas of Information Technology, TESOL and Adult Learning (sometimes a "Holy Trinity" and other times a "Bermuda Triangle"), we might wonder about areas to focus on in our forays into the world of wireless.

Of interest to all of us, whatever the field, are contributions that tell us more about how people learn. In a language learning context, I ask myself what will make a difference and if computers can be a useful part of that equation. When real achievements and gains are evidenced, how we measure them matters. In the case of the mobile wireless lab, affective factors (motivation, level of comfort, convenience, lowering of barriers that impede access and usability) can not be lightly dismissed. Higher levels of preparedness domains for post-AEI educational experiences in linguistic, cultural and computer literacy domains are always desirable. If a wireless learning environment contributes to that, then it is "paying" for itself in more ways than one.

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Blended Learning: What Do They Use in an Online Introduction to Computers For Teachers Class?

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Abstract

This paper documents an evaluation of an online class that introduces the computer to teachers through the use of several instructional tools. Those tools include a tradiional textbook, hands-on books, web-based training (WBT) modules, live chats, discussion boards, several hands-on projects with built-in grading rubrics and a "Live Classroom" (data and audio from instructor, chat from students). The results indicate that it is important to offer all of these blended components. Some students will use all of them, others will pick and choose as various needs arise and others will use only those elements that they need to fulfill the requirements of the class. Making them all available meets the needs of all or most students.

Continuing education has become an accepted necessity for retaining and upgrading knowledge and skills for jobs and living requirements. Many factors have contributed to this shift toward continuing professional development. Innovations in technology, rapid expansion of knowledge, and professional competence requirements have increased the need to continue one's education throughout an entire career (Queeney, 1995).

Further, the state of Georgia has placed a requirement on all teachers that they must demonstrate computer competence in their classroom in order to maintain their teaching certificate. Not only does this place a demand on the teacher to learn these skills, but the educational institutions across the state are now faced with the enormous challenge of either testing or teaching 90,000 teachers over the next 5 years on computer integration skills.

This Study

The focus for this study is a graduate level course, Introduction to Computer-Based Education, offered online by the Department of Instructional Technology at the University of Georgia (UGA). Under a trial agreement between the College of Education, the instructor and Epic Learning. Epic provided the technology it has developed for technical training. Epic's participation allowed the College and Department of Instructional Technology to collaborate with a corporate training company to access software that could scaffold student learning with technologies.

What students used and how they learned was the focus of this study. Because they had a large number of things available to them (books, lectures, projects, WBTs, discussion boards, chats). The first question is, do you need all these things for this class and this learner population. A second and guiding question is how do they use these things.

Methods

Methods for collecting information included the following:

- Questionnaires (midcourse and end-of-course)

  The first student survey, which included open-ended questions, was conducted through email contact with each student. The end-of-course survey was conducted through a web-based database. For both of the surveys 11 out of a total of 19 students participated.
- Observations (3 in class and 1 at a distance)

  The student researcher observed the online class from two different sites. One was in class when the instructor conducted the live online class and the other was in a place where the student-researcher was alone, simulating the situation of the students at a distance.
- Interview

  Toward the end of the semester, the student-researcher interviewed the instructor about his experience with this online class. Also the student-researcher interviewed the instructor after the class observations.
- Written feedback on the bulletin boards

  Toward the end of the semester, the instructor made forums for student feedback on the WebCT bulletin boards. The written feedback from students was also included in the data collection.

Results and Discussion

WBTs

0% said that they needed all the WBTs (covering beginning through advanced uses of Word, Powerpoint, Excel, Access and Frontpage), 40% said that they needed and used many of the WBTs. 40% said that they used and needed some of the WBTs. 20% said that they did not need any of the WBTs (these students came to the class with outstanding computer skills). Of those who chose to use a WBT, they averaged accessing the same WBT 3 times for a total of 40 minutes of use. Considering that there were over 10 WBTs, the average was over 400 minutes using the WBTs. When asked whether it was necessary to include the WBTs in the course one student said, "I love the WBT's and I DO them." 22% responded to this question and all were supportive of the use of them.

WBTs.

The hands-on books required in this class were written by Moran (1999, 2000). These "Simplyfied" books are quite good at explaining complex tasks in software applications. When asked about these texts, 45% of the students responded and virtually all supported them. Further, some used them along with the WBTs. Some used them instead of the WBTs. Some used them as they needed in collaboration with the WBTs. As one student put it, "The books were a great supplement to the WBT's some nights I just preferred to read instead of listen especially on days that I had looked at a computer screen most of the day."

Discussion Forums

The bulletin board feature of WebCT was used to share ideas about the two major integration projects required in the course. All students were required to design, develop and implement a webquest. Also, students were required to design, develop and

implement a technology integration project of their choosing into their classrooms. Each of these design projects were required to be raised for discussion before implementation. There was an average of 8 postings to each idea and virtually all projects were shaped by the discussion. While we have used discussion boards in the past, having the discussion focus on design issues is a good way to engage your students in discussion. Having worked with teachers in the past, I have been quite pleased with how the teachers seem more willing to discuss lesson plans in this context, but are reticent to do so with their peers (see, Moore and Orey, 2001, for more).

Live Chats

I have used Live Chats for two semesters with 27 different students. In that time, I have held approximately 20 office hour sessions. During office hours, I make myself available online in the chat room, next to my telephone, in my real office. Out of those 20 hours, I have had one student come in for office hours and that one student came into the Chat room. I plan to discontinue this offering and am currently exploring better uses of this technology.

Textbook

Unfortunately, now questions were targeted at the text for this class and no one spontaneously offered any feedback as to the effectiveness of this learning tool. We use the Grabe and Grabe (2001) text and believe it is an outstanding book. Later evaluations will focus on this resource.

Virtual Classroom

The virtual classroom is quite popular in this class. The virtual classroom uses streaming audio from the instructor along with powerpoint slides that can supplemented with web pages and live demonstrations of software applications. Students can ask questions via a chat like tool in the classroom. Overall, the students enjoyed these sessions. In fact, while my colleagues were using text only communication via WebCT, I was using one-way audio. Students were taking two different online classes suggested that they felt more connected to me than their other online teachers. They recommended that other instructors use this virtual classroom.

Conclusions

The primary conclusion to be drawn from this study is that it is good to blend various available technologies together to define learning experience. This particular class was split between technical skills and computer integration concepts. The former were learned through both WBTs and hands-on books and some support via the virtual classroom experience. While the design suggested that there was a progression to learning the software where the learner begins with the very guided WBTs, moves onto the guided hands-on books and then demonstrates what is learned via hands-on projects, students chose their own ways through the learning experience. Some already had the technical skills and spent virtually no time with these blended elements. Others who were just beginners needed both. Intermediates, used some of each and were able to best judge what they needed to use.

The other part of this class was classroom integration concepts. These were learned through the textbook, discussion of their ideas in the discussion boards, the virtual classroom and student's demonstrated their competence in two major projects. While these projects were all successful, we do not know to what extent the students made use of the textbook. The virtual classroom was used to reinforce and focus the readings in the textbook. The projects required the students to apply what they had learned. They applied the learning well, but we have no idea what to attribute this to. Further research is required.

There are 90,000 teachers who need to take a course like this one. Heretofore, we have offered this class at the university and limited enrollment to 15 students because there are only 15 computers per classroom. With the course now offered online through our outreach office, we can now offer this class to larger numbers of students. Because the agreement includes a teaching assistant for every 25 students enrolled, this class can grow to a much larger enrollment. However, it cannot grow to 20,000 students per year. This will continue to be a problem and internet e-learning technologies may be part of the answer.

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Framing the Interface - Determining the Level of the Interface.

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Abstract: This paper introduces a new terminology to be used when communicating about system interfaces. The terminology helps identifying where in the interface one is currently operating, from the detailed programming level to the contextual level, by using the 4 terms of being over, on, in or under the interface. The terminology is relevant for developers and researchers wanting to disseminate their work, when being used as a way of framing the area of investigation, and as mean for finding the relation between the different levels of a systems interface.

Introducing the Terminology

When referring to the term interface, the general meaning of the word indicates that it is a word with different hierarchical meanings. *"1: a surface forming a common boundary of two bodies, spaces, or phases <an oil-water interface>. 2a: the place at which independent and often unrelated systems meet and act on or communicate with each other <the man-machine interface>. b: the means by which interaction or communication is achieved at an interface."* (Merriam-Webster 2001)

As such an interface can both relate to a physical existing space, as well as a more insubstantial or virtual place, as the starting point of communication. As the use of the web became an everyday thing, so did the adaptation of words and methods that focused on new types of interfaces. Now developers are contemplating web-interface design, Common Gateway Interfaces, Application Programming Interfaces, WAP interfaces (Wireless Application Protocol), small interfaces, mobile interfaces and hand held interfaces. Just to name some, which make use of the term interface, but which deals with different levels of an interface.

A few sentences from a homepage, at the Dep. of Informatics, Copenhagen Business School, have played a vital role: *"The research interest of the HCI* [Human Computer Interaction] *group is theoretical-methodological and experimental work with design of interfaces. ... Where the psychological processes focus above the interface, computer design embodies two other perspectives. On the interface is concerned with the visual aesthetic design as it is presented on the interface. In the interface is concerned with the functional aspects, the structure and the form of notation."* (Nielsen et al. 1999). Underlined words marked for use in this paper.) While working with an update for the research groups homepage, Janni Nielsen briefly referred to this paragraph, including the term *under* the interface, referring to the programming of the interface.

After working systematically for a period with the above concepts, a clarification of the 4 terms has been made and a slightly adapted version is now used. The word *above* seemed, when presenting the idea to colleagues, to annotate that this level was somehow superior to the other levels, rather than being a level, which is interpreted as surrounding the interface or a level, which is "physically" *over* the interface. *Over* the interface thus here illustrates the contextual situation or the environment surrounding the interface.

The meaning of *on* and *in* did not seem not to present difference in level, but rather different types of interfaces. The visual, graphical and audio interfaces, which are part of the total aesthetic design of the teaching case, supports the functional and content-related interfaces. What was lacking was instead a way of differentiating between the human computer interaction taking place *on* the surface of the user interface and the relation between the different media elements with*in* the user interface. This difference has recently also been found expressed by Duma, Plénacoste & Demarey, when they defined the objectives of their interface structure *"...where the main objective is not to navigate within the interface, but rather to act on the interface"*. (Duma, Plénacoste & Demarey 1999, p.1512 - underlined words marked for use in this paper.)

When understanding the general applicability of the 4 terms, a simple example would be a person connecting to the Internet through WAP technology. This person does not know the city he is in very well, and he is getting the flu. These facts are not part of the actual interface; they are physically placed *over* and around the interface. It is the context in which the application is being used, the situation, which led to the use of the interface and the

consequences it has. The user has his eyes *on* the small screen and a hand is typing *on* the keyboard, communicating with the application, asking for the nearest pharmacy. This is what is related to as being *on* the surface, using the interface. Looking *in* to the screen of the phone, he sees a field for choosing the category for the search, whether it is restaurants, banks or pharmacies. *In* the screen there is also a small icon for each category. *In* the interface are thus the different media elements and how they relate to each other, whether it is entities, for the eye or the ear, whether they are content related or objects located *in* there for purely aesthetic reasons- or both. When issuing his request by choosing pharmacy, the program starts searching in a database based on his current location, but the actual search is hidden, it happens *under* the interface. Thus, referring to what is going on *under* the interface, is investigation of the pillars that holds the interface from *under*neath, the structure and characteristic of t he programming platform. (See fig. 1)

Over	→ Context of the interface / The environment or surroundings of the use situation.
On	→ Using the interface / Interaction with the interface "surface".
In	→ Elements in the interface / The different media entities (text, graphics…) and their relation.
Under	→ Programming the interface / The encoding of the structure of the interface

Figure 1: The 4 interface levels

A development method often provides a mean for pinpointing various interface levels, by using the phases of the method (like analysis, design and implementation). However, such phases frequently relate to the general work-processes involved in making the system, rather than the functionality and aesthetic of the actual system (or the HCI aspects), also it can be difficult to disseminate the basic content of a technical model to people unfamiliar with software development. For example, in Jim Conallens "Building web applications with UML" he describes an object-oriented approach, which uses requirement gathering and use cases to define what a system should contan and how it should be built (Conallen 2000). However, how the system should be represented *in* the interface is not dealt with, but technical constrains *on* the interaction (like timely requirements to log-on procedures etc.) are considered. It can thus be difficult to realise the system successfully, if the developer does not communicate with stakeholders and users what the functionality and "look & feel" of the system will be like. Using everyday language presented in this terminology could ensure that such relations are discussed, as Conallen himself states: *"Address the use cases with the most risk early and thus prevent unwanted "gotchas" later"* (Conallen 2000, p. 98)

The terminology identified here is method independent, and is not even a supplement to a specific method; it is merely a tool for communication about the system being built (or a system already existing). It does not eliminate having to define the particular focus of the development tasks or research depending on the type of system interface (e-commerce, learning etc.). Though, it does support identifying the level of investigation and its relation to the other levels (output from that level and input to other levels).

Acknowledgement

Acknowledgement to Janni Nielsen for the impact the HCI group homepage had on the presented terminology and a friendly thought to Jan Pries-Heje and colleagues at the University of Wollongong, who provided valuable feedback.

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The Web based Information Grid: Highly Reliable Global Information Services Infrastructure

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Abstract

The future of distributed, high performance computing and data handling system are changing by three significant technologies – Web, grids and clusters. Web consists of any combination of resources and networks that allowing user to use any application to access information, electronic transactions, etc. Grids integrate the heterogeneous and geographically distributed computational, data, and human resources of the organization, centralize and simplify system and resource management, and provide a solid foundation for both legacy and next generation applications. Clusters promise to significantly to solve both capability and capacity computing at reduce costs.

In this paper, we will identify the required functionality for grids through several scenarios that will use grids to advantage in the web environment. We will also identify the significant new capabilities that can facilitate routine construction of web based information grid architecture. This architecture will knit together widely distributed computing, data, instrument and human resources into just-in-time systems that can address complex and large-scale computing, data analysis problems, and information disseminate.

Keywords: Web, grids, clusters, high performance computing, distributed system, portal, peer-to-peer, XML

1. Introduction

Today, the way we use computers is changing by the popularity of the Internet (Web) and the availability of powerful computers and high-speed networks as low-cost commodity components. This opportunity has led to the possibility of forming new technology for the future of distributed, high performance computing and data handling system. Through the significant technologies such as Web, grids and clusters, the heterogeneous and geographically distributed computational, data, and human resources of the organization can be integrate into a centralize and simplify resource management system. Its also provides a solid foundation for integrating both legacy and next generation applications. These new technologies also promise to significantly solve both capability and capacity computing at reduce costs.

The concept of information grid is derived from the analogy of electrical power grid. Users will depend upon the ability of these grids to deliver services when they need them at any time. The users only concerned that the services are available and reliable. In the case of power supply, the users don't think about which power generator delivers the electricity to their home appliances, but they are only concerned that the power is available to drive their appliances correctly. It's seem that the networked information will face the same scenarios where users are starting to think about their access to this information and other resources through a web browser in the same way. They expect to be able to get the information such as a stock quote, a weather report, news and an airline tickets, all from the web at any time of the day.

Through the concept we could think of information grid as a seamless web computing or wide-area cluster computing that provide a large-scale and dispersed information resources consisting of aggregated computing, diverse data archives, on-line instruments and test facilities, and human collaborators within communication services such as high-speed LANs, WANs and Long Haul networks. This paper aims to present the review of state-of-the-art of grid computing and attempts to describe the principles and issues required functionality for grids through several

scenarios that will use grids to advantage for web based information grid infrastructure.

2. The Ideas of Grids

The early efforts in grid computing started as a project to link supercomputing site [5][6]. Such problems are numerically and data intensive, and these problems require a variety of heterogeneous resources that are not available from a single computer. Now it has grown far beyond its original intent and these ideas are increasingly appearing in computer literature. The applications that have been developed and will be develop include computational grids, computing fabrics, information grids and agent's grids. According to Larry Smarr in [13], a grid is a seamless, integrated computational and collaborative environment. Users in any organization just login into a client system, sent their problem tasks through the Internet (Web) and wait to get the result through their own system (as in figure 1). The grid functions can be bisected into two logical grids: the computational grid and the access grid[13]. In [7][13], the authors discussed these ideas and efforts in global computing. They also define the generic idea of a grid more carefully. According to Manola in [7], the concepts of a grid can be applied at different technical levels of computer systems such as computation, data, software, agents (smarter software) and people.

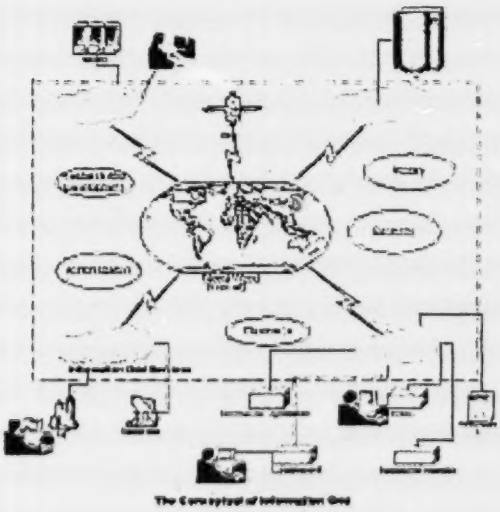

Figure 1. The Information Grid: A Conceptual

Recently, the grid-like ideas are already exist at several of these levels [5][6][7][13]. As we have mentioned earlier, these can be referred as computational grids, computing fabrics, information grids and agent's grids. NASA's Information Power Grid (IPG- www.nas.nasa.gov/IPG) is an example of a computational grid developed as a prototype production Grid system facilitating the solution of large-scale, complex, multi-disciplinary, data and computational based problems [6]. Other several projects developing technology for computational grids such as The Globus Project http://www-fp.globus.org/, PVM (Parallel Virtual Machine) project http://www.epm.ornl.gov/pvm/pvm_home.html, UCLA's Project Appleseed http://exodus.physics.ucla.edu/appleseed/appleseed.html , The Legion project http://www.cs.virginia.edu/~legion/ and etc.

Computing fabrics are another ideas involves the similar concept to computational grid and the different between these two is the focus of it application. Technologies that relevant for developing computing fabrics concept include distributed shared memory architectures, Modularly scalable multiprocessor interconnect facilities, distributed operating systems, distributed object systems supporting mobile objects, Microsoft's Millennium http://www.research.microsoft.com/sn/Millennium/, Jini and distributed shared object spaces (JavaSpaces, IBM's T Spaces) [7].

The Advanced Battlespace Information System (ABIS) [1] is an idea for information grid technology development. The ABIS grid is conceived of as an information environment including communications, processing, information repositories, and value-added services that provide the ability to find information, obtain processing services and exchange information anywhere and at any time. ABIS grid is a federated, heterogeneous system-of-system. In Network-Centric Warfare project [2], these ideas have been developed somewhat further. The Network-centric Warfare is a derivative of network-centric computing and it exploits information superiority to provide a competitive edge in warfare.

Another grid concept is develops in DARPA ISO's Control of Agent-Based System (CoABS) program. In this program, the grid concept is applied to agents in making agent-based system more interoperable and pervasive. CoABS grid is a distributed electronic environment that provides the ability to connect

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heterogeneous components together to form coherent aggregates easily.

3. Grids Architecture

Grid is a service architecture for seamless access to networked information resources and computation [5]. Recently, many researchers proposed an architecture model as a platform in providing a set of ubiquitous services that support a seamless resource access model. Most of researchers envision the grid as a layered set of services [4][5][6]. In [4], the author has proposed an architecture for computational grid called as An Integrated Grid Architecture. In this architecture, there are four layers such as Application layer, Application toolkit layer, Grid services layer and Grid fabric layer. Each of these layers provides a set of orthogonal services that may be used to construct grid-scale application. This approach has been used for other distributed system such as CORBA and the Internet.

In [6], they envision the grid architecture as a layered set of basic services that manage the resources and by using middleware; the different styles of usage can be supported. In this implementation, the services are hierarchically related and each of which performs a specific functions and may rely on other grid services to accomplish its function. In [5], the grid architecture has been simplified into three main layers that include User Portals layer, Service layer and Resource layer. In this architecture, the service layers are designed to provide the seamless fabric that allows the user to build the portals (e.g. problem solving environments (PSE)) that the applications user want.

In [1] and [2], they have different envision about the grid architecture. They described the grid architecture as a layered set of functions. In [1] the grid architecture layers include an information grid that provides infrastructure and services, a battlespace awareness capability that provides the ability to collect, process and channel information to users and the third layer is effective force employment that has many interactive parts. In [2], they also described the architecture as three tiers grid architecture where the first tier is the information grid as a network of networks consisting of communications links, computational nodes, operating systems and information management application. The second tier is the sensor grid that can be view as sets of sensor peripheral. The third tier is the engagement grids that can be view as sets of shooter peripheral and shooter applications. These two grids architecture are mainly for the operational architecture to increase combat power in the U.S Navy's Cooperative Engagement Capabilities and also to support DoD's Information Superiority concept [8].

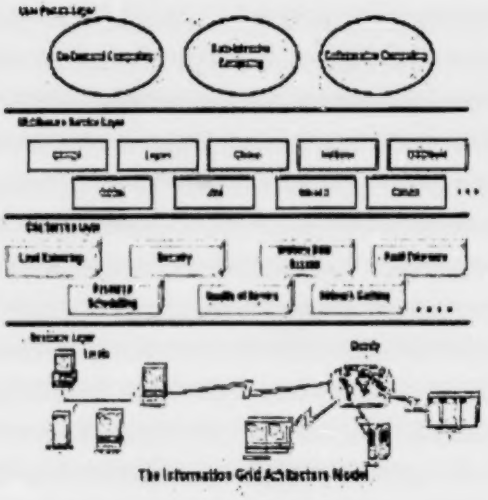

Figure 2. The Information Grid Architecture

As shown in figure 2, we simplified the Information Grid Architecture into four layers and they are briefly discussed below:

- *Resource Layer*: It comprises all the resources that can be access locally or globally across the globe through the Internet (Web). The resources could be PCs or Workstation which running using different operating system, clusters, supercomputers, storage devices, databases, and special scientific instruments.
- *Grid Service Layer*: It offers core services such as load balancing, security, Quality of Service (QoS), resources scheduling, Fault Tolerance and etc.
- *Middleware Service Layer*: It offers high-level services that allow programmers to develop applications and broker that manage remote operation of computer and scientific instruments, matching local jobs with distant computing resources.
- *User Portal Layer*: It provides grid-enabled applications based on Web where users can access their remote resources through a Web interface. The grid-enabled applications are developed using grid-enabled languages such as HPC++ etc.

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4. Grids Services

As we mentioned in previous section, the grids services functionally provide seamless interface to complex heterogeneous grid resources and these services must be completely interoperable. In modern operating system, a virtual machine can be provided for compiling application-program in a uni or parallel-processing system. However, the services required by the grid are quite different. This because of the scale and dynamic properties in grids related to the types of envisioned applications, separate administrative domains, and so forth.

In [5], Gannon has identified two sub layers of grid services: gridwide core services and higher-level application toolkit services. According to him, core services must be supported throughout the entire grid. The grid core services include authentication, security, authorization, naming and files, information, co-scheduling and advance reservation, network quality of service and events and messaging. These services might be integrated directly into the application programming model or be part of a global shell for resources access and job control. This infrastructure should be seamless as possible to the users. On the top of these core services, the users need a number of additional services to put an application up on the grid. These higher-level application toolkit services include visualization tools, scripting tools, object models and component composition tools, and publishing tools. These services layer will be used by the problem-solving environment (PSE) to interact with core services in the grid. If this science portal or problem solving environment is well design, this will make the complexity of programming the distributed system of the grid completely invisible.

5. Web and Grid Computing : The Issues

Recently, we have witnessed the growth of the Internet or Web as one gigantic distributed system or Global Computing, and it is now being used by some of researchers to try to solve really tough problem such as searching for extraterrestrial intelligence [14], finding the largest prime number [15], cracking the RC5 block cipher [16], and providing supercomputing portal using internet-wide resources [18] (just to name a few). In fact, there are many other projects have been incepted to exploit the Web as an infrastructure for running coarse-grained distributed parallel applications. However, most of these projects are focusing on computational grid. It is consider less work done for data access grid or information grid. Only a few research focusing on information grid such as The Advanced Battlespace Information System (ABIS) [1], Network-Centric Warfare project [2], high-performance Telemedicine System [17] and etc.

Although the basic techniques for Global Computing in most of the studies are well understood, several issues remain unadressed. In [19], the authors have listed several issues for Global Computing such as the ability to run a large variety of applications, economical models for resource management, performance models accounting for WAN and machine components, and new parallel algorithms based on true massive parallelism, with very limited communication capability. In order to explore potential of Global Computing, they are building an experimental platform called XtremWeb [19].

Global Computing achieves highly distributed computing by harvesting a very large number of computing resources connected to the Internet. In such cases, the main issue that raised in the grid implementation is how to create and provide a seamless computing infrastructure that support distributed, high performance computing and data handling in geographically and organizationally dispersed environment and using complex heterogeneous grid resources (see figure 1). In the implementation of Web based Information grid, there is a large range of issues related to a global computing system that should be addressed[13][19]:

- *Heterogeneity* – a information grid must involve a multiplicity of heterogeneous resources (information structures, mass storages, instruments, applications, etc) that geographically dispersed.
- *Scalability* – a information grid might grow as the users and resources grow. The applications must be designed to be extremely latency tolerant.
- *Reliability* – a information grid must extract the maximum performance from the available resources and services.
- *Availability* – a information grid must provide the service at any time in any day.
- *Security* – a information grid must protect the participating services against malicious manipulations of their other resources.
- *Usability* – a information grid must provide the ease of use system.

- *Dynamicity* – a information grid must be able to accommodate a continuously varying configuration as well as varying communication latency and throughput.

Another issues is that, a Web based information grid environment must be able to operate on top of whole spectrum of current and emerging software and hardware technologies in order to provide high level functional capabilities required for information grid infrastructure.

6. WeBIG : Web Based Information Grid Architecture

In the context of wide area clustering, the Web based Information Grid (WeBIG) should addressed all the issues that we have mentioned in section 5. It also should addressed other issues such as sizing of the grid environment component according to applications features, high performance and secure execution, modeling resource and workload management for better scheduling algorithm, and the impact of the application characteristics [19]. The proposed architecture (see figure 3) will be served as an infrastructure for computational and, data and information access grid. We know that, the information grid might grow as the users and resources grow, and with better mirroring and caching system, the information grid will be able to extract the maximum performance from the available resources and services, and provide the service at any time in any day. In our approach, mirroring and caching system will be the important issues that should be addressed. However, these issues will not be discussed in this paper. What we are going to highlight in this section are, the three promising technologies, XML, Peer-to-Peer(P2P) computing, and multi-agent that could be used and give some advantages in the implementation of our proposed data grid handling system architecture.

XML supports data portability as a platform-neutral document description meta-language that offers means for data serialization[20]. Some of the expected XML benefits are:

- XML appears to promptly become a standard and has a potential role as a universally accepted format for the exchanging information between heterogeneous application systems.
- XML is expected as one of the primary means for developers to design multi-tier applications in heterogeneous environments.
- XML has an interesting perspective in defining and using metadata that can be exposed through XML message.
- XML supplies cost-effectiveness for implementing distributed applications based on XML software tools and component.
- XML provides a way of tagging data and objects as the called on a network.

Peer-to-peer(P2P) computing isn't exactly new. However, today, several factors have lit a fire under the peer-to-peer movement such as inexpensive computing power, bandwidth, and storage. Peer-to-Peer(P2P) computing is the sharing of computer resources and services by direct exchange between systems. These resources and services include the exchange of information, processing cycles, cache storage, and disk storage for files. Peer-to-peer computing takes advantage of existing desktop computing power and networking connectivity, allowing economical clients to leverage their collective power to benefit the entire enterprise. In a peer-to-peer architecture, computers that have traditionally been used solely as clients communicate directly among themselves and can act as both clients and servers, assuming whatever role is most efficient for the network. This reduces the load on servers. Using a network of computers, P2P technology allows large-scale computer processing needs and optimize idle CPU MIPS and disk space. There are some success stories of P2P application development such as Napster[21], Konspire[22] and Gnutella[23]. These applications have offered a compelling and intuitive way for Internet users to find and share resources directly with each other, often without requiring a central authority or server.

Peer to peer computing also allows computing networks to dynamically work together using intelligent multi-agents technology. Agents reside on peer computers and communicate various kinds of information back and forth. Agents may also initiate tasks on behalf of other peer systems. For instance, Intelligent agents can be used to prioritize tasks on a network, change traffic flow, search for files locally or determine anomalous behavior and stop it before it effects the network, such as a virus. Multi-agent also being used for integrating database, where, the interaction with the database is done via agent namely: the client agent and the database agent. Figure 3, shows the proposed architecture model of our WeBIG infrastructure.

Figure 3. The Component of Web Based Information Grid(WeBIG)

We have also mentioned in previous section, that in a grid computing environment, the user do not care with the details of its underlying hardware and software infrastructure, what they are interested, getting the result in a correct and timely manner when they submitting their application. In such cases, there are several service features required in designing this type of environment, and these services should be addressed all the related issues. Figure 4 shows our proposed data handling model for WeBIG. This model is build on the top of the technology that provides by the JXTA project. The Core and some of services are provide by JXTA project[24][25].

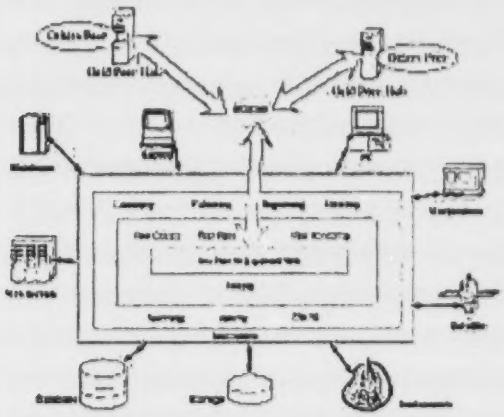

Figure 4. The WeBIG: Data Handling Model

In an ideal grid environment, the grid services are required to provide the applications, users and resource provider to operate effectively. The grid services should provide access and communicate with a wide range of information sources (local, community, international and world resources) (as in figure 4). It also should provide the ability to incorporate remote computational and information resources, and also performance guarantees for data and information transfer, and computation as required. Through grid core services, its can give the web more capabilities to become a suitable and potentially infinite scalable metacomputer for parallel computing, collaborative work, etc. It is also as a key technology to create and provide a pervasive and ubiquitous Web based information grid infrastructure. Moreover, the user's information space such as the configuration of files, videos, audio clips and computations that the user last accessed, should be instantly available no matter where or how the user has chosen to access the grid. Thus, the grand challenges in current information grid research are the issue in making all of this services available transparently to the user through web environment.

7. The Information Grid Development Scenario

As an example, let us consider a scenario in our university, Universiti Utara Malaysia (UUM). When top management officials need to make decision, they need all the data and information. The problem is usually, finding the right person to get the data. Once the person in charge has been located, he must go to the right location where the data is stored. By using one component of WeBIG – data and information access grid, its will eliminate all the hassle in finding the right data at the right time anywhere, when it is desperately needed. All the necessary data for top management officials will be stored and with a single click, the data can be accessed at any given time anywhere. These data will then be processed by WeBIG component and required output will be generated (an example is, the physical graph of the students performance, or last month budget according to departments), thus decision making can be made more effectively and efficiently.

In a business, which is committed to excellence, the need for performance management and improvement is everywhere. The information grid solution represents a breakthrough in the ability of organizations to create knowledge and manage performance pervasively. This knowledge action system lets people point, click, and most importantly, add textual interpretation to turn information into knowledge and then to create value

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through action, while exploiting the power of groupware/knowledge management software to make that knowledge available to the people who need it wherever they are (even mobile workers). The move towards a more network-based economy is forcing many businesses to fundamentally alter the manner in which they do business. Competition between organizations is accelerating. Organizations must be able to start simple and grow fast. For instance, a company that initially establishes a web site to provide general information about the company may soon find themselves wanting to include support for direct communications (example e-mail, calendaring and scheduling, etc.) between its departments and staffs. The rationale is, to produce an infrastructure such as information grid, that can be used by the organizations' top management in enhancing the deliverance of its decision making application, which at the moment is usually done through face to face communication. Furthermore the communication between an organization's top management officials and their subordinates can be done at any time with the assistance of this medium.

7. Conclusion

In this paper, we have described the state-of-the-art of grid computing. We also included the main issues on Global Computing, potential technologies such as XML, Peer-to-peer and multi-agent technology, and other related issues such as services architecture and information grid components, that will be consider in the implementation of our proposed architecture – WeBIG (Web Based Information Grid). Currently, there are a large number of projects and diverse range of emerging grid development being pursued. Here, we noticed that all of these projects range from metacomputing, application testbeds, collaborative environment and batch submission mechanisms[13].

Until now most of the projects and research have been focused on computational grid. In the near future, the growth of the Internet and Intranet usage will also ultimately benefit from grid-like structures as well. We are hoping that, the IT providers will use grid-like structures to supply high-performance computing services to all communities including the commercial world. The interactive, transaction-based application required by the growing use of e-business-related solution can be solved using the grid-like structures. As mentioned by Mirza in [9], the grid technology is not just can be used as a solution for heroic compute-intensive applications that need prodigious amount of computing resources, which single supercomputer cannot satisfy but also can be used as a solution for organization with distributed resources to connect them together so they can function together. In the global economy and the trend toward leveraging the Internet's standard, and connectivity to transform key business processes of a global organization, the information grid can provide a solution to the problem of distribution. In the future, organization and corporations will use grid-based solution to run their operations and businesses. The web based information grid infrastructure will be able to provide a better way of running their operation and businesses as a highly competitive enterprise.

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Dynamic Composition of Web Server Functionality over the Internet

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Abstract: The Internet has changed from a relatively simple network of connected computers with rather primitive functionality to a sophisticated virtual world with many services, huge amounts of information and interaction possibilities between people. However, many Internet providers still use Web servers in an old-fashioned way, only to provide Web space to their customers. They can upload home pages and share other data files over the web, but they are not enabled to share functionality and to extend the used Web Server. In this paper, we present an approach that allows users to remotely extend or enhance the functionality of a Web Server by integrating self-defined modules without modification of the existing implementation. The proposal is based on extending a Java Servlet framework during runtime with dynamically loaded Java classes retrieved from the Internet. Finally, an ongoing research project is presented, where our proposal is already used to develop an open scalable Web Server.

Introduction

The Internet is a steadily growing pool of various Web Servers, each providing particular types of information. While many Web Servers provide simple sharing of static HTML pages, there are also web servers, which offer additional functionalities like search engines. These extensions enable users not only to browse, but also to search for the desired information (Catarci 1999). A further step is the introduction of more structured underlying information storage systems, such as database systems and XML repositories, which allow to access more fine-grained information items, instead of providing an entire, static HTML page (Kappel et al. 2000) (Petrou et al. 1999). To realize this approach, the native Web server is typically extended with a request handler which can access single information items upon client requests and uses them to construct HTML pages on the fly as response.

Even though Web Server can provide new additional services that way, users can nevertheless only use pre-installed services and access the data via provided interfaces. In particular, they are not allowed to extend the server during runtime with new functionality tailored to their specific needs. Furthermore, users want not only to share information, but also to share functionality. This has fostered the desire to enable users to extend Web Servers dynamically with distributed extensions and components, which are provided by other users.

In this paper, we present a Java-based approach for a composable Web Server. It allows users to customize it remotely with self-defined modules, integrating additional functionalities transparently without modification of the existing system. The proposal is based on extending a *Java Servlet Framework* during runtime with dynamically loaded Java classes, using the *Dynamic Class Loading* feature of Java, which has been enhanced to retrieve classes from various data sources, not only the local file system. Thus, our solution enables an integration of remote Java classes from anywhere in the Internet. In addition, we show how the *reflective facilities* of Java can be used to dynamically resolve user requests and find the appropriate request handlers. This allows us to completely decouple the implementation of the used information system from the realization of the user-defined modules.

The paper is organized as follows. In section 2, we present our proposal to build a composable Web Server. In section 3, the use of our approach within an ongoing project is illustrated. Section 4 concludes the paper and outlines areas of future work.

Composing Web Servers Remotely with Distributed Extensions

A Composable Web Server

Our proposal to allow the extension of an existing Web Server is based on the conceptual architecture (Fig. 1), where additional extensions can be plugged in and configured by users independently.

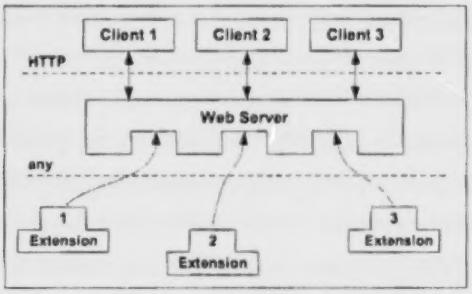

Figure 1: System Architecture

Extensions can be provided by the user and transparently plugged into the framework. Therefore, application code can be spread into the Internet, similar to HTML pages. This boosts the reuse of application classes, and simplifies their distribution as well as their maintenance.

Realization Using a Java Servlet Framework

To realize the above presented architecture, a *Java Servlet Framework* is employed. In this context, Java offers the best features, due to its possibilities to implement server-side Java applications called Java Servlets (see Hunter et al. 1998) and the simultaneous integration of a wide-spread template engine (Fig. 2) with *Java Server Pages (JSP)* (Hall 2000) and *Extensible Server Pages (XSP)* (Apache Software Foundation 2001)

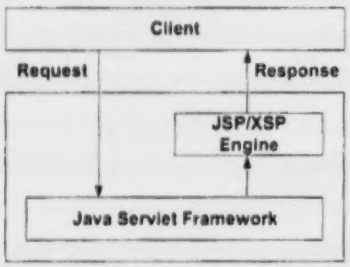

Figure 2: Java Servlet Framework

The composition of Web Servers with a new functionality includes the ability to extend the server with applications and to adjust the data presentation capabilities. The latter can be easily achieved by using the JSP/XSP engine and providing the corresponding template files.

But what about applications? For this purpose, Java offers an outstanding ability with its *Dynamic Class Loading* concept (see Eckel 2000). We utilize and extend this feature in our approach to build up a *Dynamic Extension Loader*, which can load and add remote classes dynamically. In addition, the classes can be located elsewhere on the Web, assuming they can be addressed via a URL.

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Request Dispatching

The dynamic extensibility of the Web Server and the usage of dynamic class loading raise another important question: how can the system determine and find the application that satisfies a client request? Which classes have to be loaded, and which methods have to be called upon a client request? Our approach to address these questions is described in more detail in the following.

Request Dispatching Using Direct Mapping

When a client request is received by the Java Servlet Framework, it has to be dispatched to the correct method. As long as the number of request types is small (like in the ordinary HTTP protocol), the requests can be directly mapped on the methods of a particular service class. For example, the servlet API provides a class `javax.servlet.http.HttpServlet`, which has methods for PUT, GET and POST requests. The dispatcher calls each method directly upon the related HTTP message.

Request Dispatching Using the Command Pattern

When the number of request types becomes larger, and the platform should be configured dynamically to deal with various requests, the request handler must be designed in a more flexible way. The ordinary approach is to introduce a command handler which manages various command objects, each encapsulating one request type. The related software design pattern is known as *Command Pattern* and described in (Gamma et al. 1995).

The major advantage of this pattern is its ability to decouple the framework and the particular command. For this purpose, the framework delegates the received request to the command handler which determines the correct command object. In this case, the particular command object that has to be called is transparent to the framework. The command handler manages the command objects and offers the ability to register new ones during runtime. While this ensures the extensibility with many command objects, it also has some drawbacks inherent to the Command pattern. A minor drawback is that for each request type a separate command object has to be introduced and registered, increasing the number of classes very fast. Consequently, each command object has to be registered before it can be called.

But the major disadvantages are the constraints imposed by the Command pattern to determine the correct method. This includes subclassing a common, abstract command class and implementing some special methods, which rather limits the flexibility by imposing certain constraints. In the following, we describe our implementation and its advantages over the above approaches.

Request Dispatching Using the Facade Pattern and Reflection

Our proposed approach benefits from some features of the programming language Java. First of all, we encapsulate the handling of various client requests within methods of a certain application class instead of separate command classes. While this obviously reduces the number of command objects, it also decouples the client from the application, the underlying subsystem. This approach is also known as the Facade design pattern (Gamma et al. 1995). Before determining the method related to a client request, an application dispatcher is used to find the corresponding application facade. To achieve this, the application dispatcher evaluates a given parameter `application` within the request which denotes the class name of the application facade.

In contrast to the Command pattern, no previous, explicit registration of the application facade is required, but rather it will be located and loaded dynamically using the class name. This also enables the network wide distribution of application facades and does not rely on assumptions regarding subclassing or implementation of certain methods. The location of the requested classes is the task of the *Dynamic Extension Loader*, which supports various ways to achieve this. The easiest way is to provide a mapping between the class name and the location where to find the class. Although this limits dynamical extensibility to the registered handlers, it also enables some sort of control related to extensibility by third persons. Another option uses the class name itself (Fig. 3), whereby the handler name denotes the Internet address. In this context, no mapping is needed, but the handler name must be selected accordingly.

```
http://netzspannung.org?handler=http://www.uni-siegen.de/cat.application.jour
nal&method=printArticle&id=42
```

Figure 3: Localization by enclosed URL

For example, in (Fig. 3) the handler is supposed to retrieve a class `cat.application.journal` from `www.uni-siegen.de` and to print the article identified by the id `42`. Either way, the extended *Dynamic Extension Loader* is able to load the class from local file systems and network resources, such as Web servers or databases. After the appropriate application class has been loaded and the related object has been instantiated, the client request must be handled by the corresponding method. But how should the relevant method be determined? Our answer to this question relies on using another parameter in the client request, called `method`, and on employing the *reflection mechanism* of Java to find the correct method.

Basically, there are two options to determine the relevant method. In the first option, all methods have the same parameter list, and the method dispatcher does not need to evaluate the parameters in the client request further, rather the called method does this by extracting the parameters from the servlet request. In the second option, the method dispatcher evaluates all parameters of a client request and uses them to find the appropriate method. Both options have their advantages and drawbacks. While the first option is not as flexible as the second, e.g. it cannot easily be used for overloaded methods, it simplifies and shortens the reflection process. The second option can be used with all object implementations without modifications, but it is more complicated and its execution takes longer, since each given parameter must be checked against the expected parameter type.

The decision which option to use depends mainly on the scenario envisaged. In case of a Java servlet, all client requests are made via HTTP; the server extracts the calling parameter from a `HttpServletRequest` object and responds to the client with a `HttpServletResponse` object. Among these tasks, the objects provide several other servlet and client specific data and functions like session context and access to the output stream for writing the resulting HTML page. Therefore, each servlet request handler needs both objects anyway, and the methods of the request handler have to be set up to include at least these objects as parameters. In any case, since the parameters of the HTTP request have to be extracted anyway, we decided to leave the task of extracting the calling parameters to the particular request handler. This simplifies the usage of the approach and speeds up its execution time.

However, in other scenarios it may more convenient to handle the parameter extraction before calling the requested method. Such scenarios are, for example, the integration of existing implementations, or when the tasks between network handling and application design should be completely separated.

Sample Code

In the following, we illustrate certain implementation issues in detail with sample code snippets. The first example (Fig. 4) is an extract of a request handler implementation.

```
public void printText(HttpServletRequest req, HttpServletResponse resp) {
    HttpSession session = req.getSession();
    String text = req.getParameter("text");
    resp.getWriter().println("Session-ID: "+session.getId()+", Text:" +text); }
```

Figure 4: Request Handler Method

In this example, a simple method `printText` takes a parameter named `text` and inserts the value in the corresponding HTML page. Additionally, the related session id of the client is also retrieved and printed.

The next code snippet (Fig. 5) illustrates the implementation of the application and method dispatcher. The method `dispatch` takes the parameter `handler` to retrieve the corresponding request handler. Afterwards, it uses a simple cache implementation to find out whether the handler has already been used and instantiated. If not, the needed class is loaded by `forName`, and a new handler object is instantiated and put into the cache. The next step determines the requested method from the object, using the reflective method `getMethod`, and calls the retrieved method with `invoke`. The used class loading mechanism is the built-in class loader to simplify matters. In case of Internet distributed handler implementations, it has to be extended with the ability to load byte codes over network connections like HTTP or FTP. However, this extension is quite straightforward, as described in (Eckel 2000).

```
private HashMap handlerMap = new HashMap();
private static final Class[] paramArray = {
    javax.servlet.http.HttpServletRequest.class,
    javax.servlet.http.HttpServletResponse.class
};
public void dispatch (HttpServletRequest req, HttpServletResponse resp) {
    String handler = req.getParameter("handler");
    String method = req.getParameter("method");
    Object o = handlerMap.get(handler);
    if (o == null) {
        Class c = Class.forName(handler);
        o = c.newInstance();
        handlerMap.put(handler, o);
    }
    Method m = o.getClass().getMethod(method, paramArray);
    m.invoke(o, new Object[] {req,resp});
}
```

Figure 5: Application and Method Dispatcher

An Application Example: CAT

The presented approach has been developed as part of the framework *ODIN (Open Distributed Network)* (see ODIN 2001) and is currently being used in an ongoing research project called *CAT (Communication, Art & Technology)* (see Fleischmann et al. 1998), which is intended to build up the upcoming information, communication and production platform for art, culture and new media in Germany, called *netzspannung.org* (see Netzspannung 2001). It is funded by the German Federal Ministry for Education and Research and is developed by the research group IMK/MARS from GMD, St. Augustin in cooperation with our group at the University of Siegen, Germany. The CAT platform is heavily based on the idea of developing a distributed system for connecting open communities spread over the Internet in a new way. For this purpose, the projected Internet platform should be open for adaptation with self-defined modules, which can be located anywhere in the Internet. In (Fig. 6) it is illustrated how the CAT platform can particularly benefit from the presented dynamic adaptation approach.

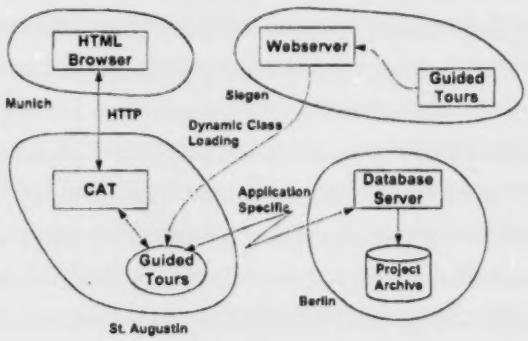

Figure 6: Dynamic Request Handling

As an example, suppose a client in Munich accesses the Internet platform CAT with an ordinary HTML browser using the network protocol HTTP. To serve the original request, CAT loads the corresponding Java classes dynamically over the Internet and instantiates them on the server in St. Augustin. Afterwards, the request will be handled by a particular request handler which accesses the data archive in Berlin over a possibly proprietary network connection and prepares the HTML pages for the client in Munich. The overall process is completely hidden from the user in Munich. Even the system in St. Augustin does not need to be configured to handle the specific request. This is a great step towards an Internet platform which acts as the "glue" between existing Internet services, and provides a common environment in which users do not need to know where and how their requests can be performed. In addition, CAT should also be used as a "media lab" on the Internet. In particular, this includes the

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offer for artists to use the platform as a tool wherein different applications and data archives can be connected to new kind of Internet services. The presented approach is the basic technology to achieve this goal by enabling users to add new functionality on their own.

Conclusions

In this paper, we have presented an approach for dynamically extending a Web Server, which is based on extending a Java Servlet Framework with new functionalities using *Java Reflection* and *Dynamic Class Loading*. We have illustrated the main implementation issues and demonstrated the application of the approach in an research project.

There are several issues for future work. For example, a current project is engaged in the integration of *XML* and *SOAP*, which are not only used for Web applications, but also for general distributed Internet applications (McLaughlin et al. 2000) (W3C 2001a) (W3C 2001b). SOAP offers much more structured information than HTTP, therefore the name and parameters of a remote method call can be easily checked against the correct order and type without knowledge of the underlying implementation. This allows to apply the proposed approach to almost every object implementation without special design issues like the usage of `HttpServletRequest`.

There are several tools and libraries to deal with XML streams even before they are transformed into method calls. Especially for an open Internet platform, the introduction of "intermediaries" enables a new kind of interoperability with dynamically integrated implementations and is not even bound to a particular implementation language. A related approach is proposed in (Barrett et al. 1999), which uses intermediaries to manipulate XML streams and which are applied during runtime.

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XML-Technologies for the Support of Active Learning in Interoperable and Open Web-based Learning Environments

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Abstract: Web-based educational systems benefit from dynamic and interactive features that facilitate active learning. Web Services – new XML-technologies for services on the Web providing service descriptions and communication protocols - have been suggested to integrate various, possibly interactive services into a Web-based system. We argue that these are suitable for the educational context, but additional methods and techniques addressing learning processes, course sequencing and content packaging are needed to fully support the development and management of learning environments. This is in particular important in the context of efforts to standardise learning technology concepts and systems archictectures. We look at an active learning environment to illustrate the issues arising.

Introduction

HTML and HTTP have been proven to be suitable technologies for simple Web-based educational systems. However, most Web-based teaching and learning environments benefit from more interactivity. The current trend in Web-based systems goes towards more dynamic and interactive environments (Grønbæk & Trigg, 1999), (Lowe & Hall, 1999). We will argue that suggested technologies for a services-oriented Web (W3C, 2001), dubbed Web Services (Vasudevan, 2001), are suitable for some requirements stemming from the educational context, but do not satisfy all needs for dynamic interactive systems. We will present concepts how to extend the suggested technologies to a framework overcoming the identified shortcomings, which is suitable for the development and management of dynamic and interactive Web-based educational systems.

Some organisations are working on standards for educational systems technology. The IEEE works on a Learning Technology Systems Architecture (IEEE, 2001). This architecture aims to provide a framework for understanding educational systems and to promote interoperability and portability of such systems. We will investigate the role new XML-technologies (eXtensible Markup Language) can play within the context of these efforts. As a case study an active learning environment will be looked at. Important framework aspects to be addressed are communication protocols between instructional agents (parts of the delivery system that co-ordinate the learning process and guide the student) and external services used in the educational system. Course sequencing (the management of learning sessions) and content packaging (structuring educational material into units for delivery) are other important aspects.

Our objective is to investigate an open and interoperable Web-based architecture for educational systems, allowing distributed and independent services in such systems to be integrated. This architecture should allow a teacher to be involved in the development and maintenance of Web-based courses. We will focus on server-side interactive services for a course. We aim at maintainable system architectures consisting of basic services with clear interfaces. The execution of delivery system, external services and assessment functionality shall be separated. This kind of open architecture avoids problems that occur if part of a system has to be delivered and installed on the student's computer – technical and legal ones. Mobile code, such as Java applets, is also problematic. A services-based architecture allows interoperability of services between different courses and institutions – an important criterion for configurable and maintainable e-learning systems.

Active learning is the paradigm that shall be investigated. We can distinguish different forms of interactive services, such as executions and simulations, or textually and graphically manipulated services. An interactive service is a feature that reacts on student input and that is used repeatedly by a student in order to fulfil a learning goal. We need to look at learning processes involving the student on the one hand, and at technical issues like the

architecture and delivery system on the other hand. We shall illustrate our ideas by a course for third-level education, but our results can also be applied to other forms of Web-based teaching and learning.

Active Learning – an Example

For an educational system on the Web, the problem of knowledge representation is a very significant one (Stutt & Motta, 1998). A development and management framework needs to provide a vocabulary to structure and describe knowledge – the course content - in an education-oriented but also subject-specific way. A second element is a set of rules guiding the use of the vocabulary. The eXtensible Markup Language XML is an ideal candidate for such a notation. Various education-specific XML-variants have already been created (Fox, 1999), (Koper, 2000), (IMS, 2001). Assuming that most teachers involved in Web-based teaching are computer-literate, but not experts in computer programming, XML is an ideal notation to develop and maintain educational systems. The teacher would use predefined educational and subject-specific markup definitions - in form of Document Type Definitions DTD - and would develop a Web-based course using the vocabulary and structural guidance provided by the DTD.

Our example shows subject-specific markup. It represents an SQL database query. This will also lead us directly into interactive services. We took this example from course content for a database course (Smeaton & Keogh, 1999). SQL is a standard database query language. Each query can be described by several elements: a number, a name, a query string (in plain English) and the query formulated in SQL.

```
<DBQuery>
  <Number>   1                                                          </Number>
  <Name>     SIMPLE QUERY                                               </Name>
  <QueryStr> Get colour and city for parts with weight greater than 10 </QueryStr>
  <QuerySQL> select colour, city from parts where weight > 10           </QuerySQL>
</DBQuery>
```

We have used XML-tags in this document excerpt that are specific to the course subject, here databases. The DTD defines the tags (elements) to describe a database query:

```
<!ELEMENT DBQuery (Number,Name,QueryStr,QuerySQL) >
<!ELEMENT  Number       (#PCDATA) >
<!ELEMENT  Name         (#PCDATA) >
<!ELEMENT  QueryString (#PCDATA) >
<!ELEMENT  QuerySQL     (#PCDATA) >
```

Each of these elements is a character string (PCDATA). The tags `Number`, `Name`, `QueryStr`, and `QuerySQL` are part of the database ontology, i.e. terms of a database vocabulary that allows us to talk about SQL queries. However, the DTD does more than only defining the vocabulary for our course subject, it also defines how to structure, or how to write a description of a query. In this case a simple hierarchical structure with the `DBQuery` element as the root and the other tags as subordinated elements.

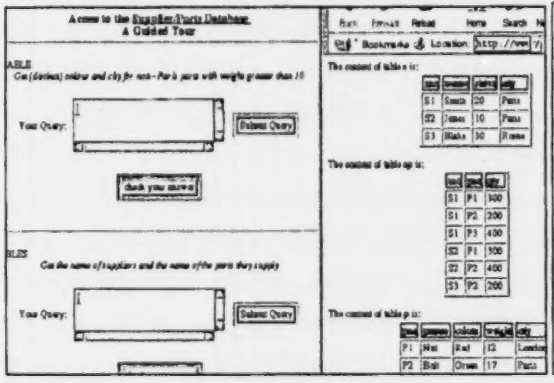

Figure 1. Interactive SQL Service

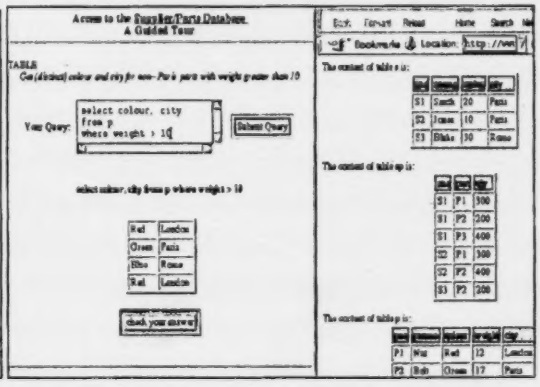

Figure 2. Execution of Interactive SQL Service

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An educational system should support the paradigm of active learning. In many subjects students have to train skills – they learn by doing, possibly in a dialogue with the teacher. We will illustrate this idea by an interactive educational service in a Web-based database course. The interactive part teaches the database language SQL in an autonomous style. The system replaces the teacher in the learning dialogue. The SQL-example could serve as a static example in a course. However, the XML-specification forms the basis for an interactive exercise here. Figure 1 shows the online representation of the XML-description of a SQL database query (in the top part of the window on the left). A student can type a solution attempt into the text field and submit the attempt to a remote database server, which executes the student query and returns a result – a table containing records in this case, see Figure2. This example shows the need to integrate the description of static elements (the XML `DBQuery`) and the use of an external processor (the database server) to execute student input. The teacher or course developer needs to address both issues. In addition, he/she also needs to describe the overall learning process, which describes how the student is supposed to work with the interactive service(s). An example could be the expression `DBQuery1* ; DBQuery2* ; DBQuery3* ; ..` saying that `DBQuery1` (which denotes the query with number 1) can be executed repeatedly, before continuing with `DBQuery2` (repeatedly), then `DBQuery3` and so on.

Educational Systems

A number of aspects distinguish educational systems from other, for example more business-oriented systems on the Web. We look at the main *roles* and *types of services* to clarify this difference. The main roles within an educational system are – not unexpectedly - the teacher and the student. A computer-literate *teacher* plays a key role in the development and management of educational systems. The teacher has to model and facilitate learning within the system. This can be divided into different aspects:

- *Static content*. This can be realised by a document- (rather than data-) centric use of XML, i.e. the use of XML to structure and package educational units into documents.
- *Navigation*. Complex navigation patterns occur: long sessions, repeated visits over long periods. Dependencies and behavioural patterns need to be expressed using a powerful notation, sessions need to be managed.
- *Interaction*. Repeated and varied use of configurable services needs to be anticipated and described. The services need to be integrated with other services and instructional agents into the delivery system.

The fact that the teacher is usually not an expert in Web technologies has to be considered in all these aspects. The *student* uses the system differently from a customer in a business site. The ultimate goal for a student is learning. Learning differs from shopping for example in the time span involved. The student will visit repeatedly, spending long times for each visit. The student can be expected to be skilful in using the system (after an initial period of learning how to use the system). These short characterisations of the main roles in Virtual Learning Environments (VLEs) shall help us to identify requirements for methods and languages for the development and management of VLEs. Another aspect that needs to be looked at in our analysis concerns the types of services needed in a VLE.

We have already seen an example of one of the *service types* – the SQL execution service. Services can either purely execute input based on some instructions – as in that example - or can be more closely integrated into the context. An example for the latter is an assessment or evaluation service. Both execution and assessment service can be executed in parallel based on the same student input, yielding an execution and an assessment result at the same time. Assessment services are more tightly integrated into the context than pure execution services. Input elements for an assessment service can include the student attempt for the problem, the correct solution, and the student profile. The correct solution and the student profile are implicit parameters – not visible to the student. Output elements could include the correct solution (displayed to the student), an explanation of mistakes, and context links providing background for the mistakes. An assessment service might also update the student profile. The assessment service needs to know about the context in order to provide suitable output. Explanation has to be given in the context of the course material, with links to material that might help the student to overcome possible problems. This could be solved by a standardisation of the subject domain. A standard vocabulary, or even an ontology, would need to be mapped to concrete course elements. An independent assessment tool could provide links in terms of the standardised vocabulary. We have considered only one interactive service for our system. Other interactive services, that can support our course, are the use of a diagrammatic design notation for database applications, an animator tool to illustrate the execution of database commands, or an inference tool allowing the student to verify optimisation carried out on a database design. This collection of services clearly shows the need for a powerful modelling notation and an open and interoperable course environment.

We have raised some issues important in the creation of a notation for the development of active learning environments. Starting of from with course delivery systems, where the static content is structured and represented

using educational and subject-specific XML-markup, two problems arise if interactive services have to be integrated into this system. They shall be addressed in the next two sections.

1. The *description* and *implementation* of the *educational process* underlying the student's usage of the system including the interactive services and the navigation structure.
2. The *integration* of the *tool* that performs the interactivity (a database server connected to the Internet in our case). This requires adequate technologies, such as protocols, and abstract description notations.

Modelling Active Learning

Invoking an interactive educational service is usually not a once-off activity. The educational service is embedded into an educational context, into sessions forming the learning process. The service might be used repeatedly, possibly in variations. The teacher needs to model and implement this process involving the educational services. The interaction between user and computer needs to be described. The SQL system presented earlier on illustrates this problem. The interactive service is realised as a guided tour providing problems with increasing difficulty. The student exercises each problem until a satisfactory solution is achieved and then move on to the next problem. We have already suggested to express this by `DBQuery1* ; DBQuery2* ; DBQuery3*`. Each `DBQuery` in this expression corresponds to the sample `DBQuery` (see above). We have described how this query is executed using an external Web service. The expression describes a pattern, a part of the learning process defined by the teacher or course developer. These patterns are important for integration of design and evaluation in this context (Britain & Liber, 1999). The way students learn with Web-based environments is not fully understood. Evaluation is therefore highly important in order to understand the user, to create a user model from the evaluation results and to provide an environment, which suits the needs of the user. Redesign of the learning process might be a consequence of an evaluation. Explicit modelling of these patterns can support both evaluation and design.

In order to develop a suitable model and notation, we need to make some issues more precise. What exactly is meant by for example `DBQuery1`? As we can see in the figures it is a page with textual elements and an input facility for the interactive service. We need to define the notion of a page. How do we describe the processes? We need to define a control flow language to describe the educational processes. The teacher is deeply involved in development and evaluation. Suitable notations and technologies to support the teacher are needed. We propose a framework that integrates Web Services technologies (XML, WSDL, and SOAP, see (W3C, 2001)) with a notation to express content representation and the process of learning. Web Services technologies alone are not sufficient. We propose a basic model forming the foundation of the envisaged notation. The main model elements are:

- *Static page structure*. This aims at the representation of knowledge (static content). The layout is irrelevant here; the assembly of individual units is dealt with elsewhere.
- *Dynamic elements*: Instructional agents and *external services* (services that implement interactive or other features. Typically, an input or activation facility is provided; the activation results in a page transformation.
- *Learning process:* described by a control flow expression on pages.

The model essentially describes a transitional system based on state – or page – transformations. Transformations can be caused in two ways. Either by following a link (within the static or dynamically created elements of the page) or by executing an external service – this service is located using a URL – the service execution will result in an updated page. The formalism needed to describe the *learning process* (the teacher-learner or system-learner dialogue) should provide concepts to describe sequences, concurrency, synchronisation and conditions in order to express dependencies between course units, optional units or possible choices that a student might have. Petri-nets could form the basis of this formalism (De Bra et.al., 1994). Petri-nets are graphs consisting of two kinds of nodes, called places and transitions. Places could represent pages in a Web environment; transitions could represent services or links. Some elements of the model shall be looked at in more detail.

Pages occur in tow forms: static pages and service pages. A service page is essentially an abbreviation for a basic process with `P` as the start page and `R` as the result page reached by executing the service. We assume that a link exists to go back to `P`. The process specification used earlier on was `DBQuery1* ; DBQuery2* ; . . .` This is a specification on the level of page identifiers. Each of these pages has a structure consisting of static, dynamic and service elements. These identifiers work as macros that are expanded when needed. For example the first page `DBQuery1` could be specified as

```
<Context  name="c1">      ...                              </Context>
<Interact type="exec">    ExecQuery(in)                    </Interact>
<Interact type="assess">  AssQuery (in,correct,context)    </Interact>
<Context  name="c2">      ...                              </Context>
```

expressing that two static elements and two service invocations (execution and assessment) constitute the page. This is a service page, i.e. a basic process. The DTDs needed for the specification of pages are education- and subject-specific markup for the static part and a protocol DTD for the service invocations (e.g. XML Protocol).

We have already seen some *control flow* primitives being used. The full list is sequence ';' , choice '+' , iteration '*' , and concurrency '|'. A deterministic choice can be derived from the non-deterministic choice. An option can also be derived from the non-deterministic choice as [P] :=P+ε where ε is the empty (null) process. The control flow expression `ExecQuery1* ; ExecQuery2*` can be expressed in an XML-style language:

```
<Sequence>
   <Repeat> <Interact type="exec">    ExecQuery(in1)    </Interact> </Repeat>
   <Repeat> <Interact type="exec">    ExecQuery(in2)    </Interact> </Repeat>
</Sequence>
```

Architecture and Implementation

The tool performing the interactivity is an external process separated from the delivery system. A problem is to interface and integrate such a tool into the content delivery system. We need notations to specify the external services abstractly and to invoke these services remotely. An abstract and easy to understand notation helps the teacher handling parts of the configuration and customisation of the system. Technologies are needed to implement the integration described by the teacher. Two technologies for this problem, forming the core of the XML Protocol standard, and also the Web Services framework (W3C, 2001), are WSDL *Web Services Description Language* – an XML-based markup language to describe services offered on the Web – and SOAP *Simple Object Access Protocol* – a protocol to invoke remote services based on HTTP. Web Services are a framework for the registration, discovery, and invocation of remote services in a distributed environment. A standardised version, XML Protocol, is currently under development. The following excerpt specifies an external SQL query processor using WSDL:

```
<message  name="InQuery">     <part name="body" element="QueryString"/> </message>
<message  name="OutQuery">    <part name="body" element="QueryResult"/> </message>
<portType name="ExecQueryPortType">
      <operation name="ExecQuery"> <input  message="InQuery" />
                                   <output message="OutQuery"/>      </operation>
</portType>
```

The previous definitions (`messages` and `portType`) describe the service abstractly. We have omitted proper type definitions and some other details here. The two messages describe the data items passed as input and output to and from the system. Two other tags (`binding` and `service`) allow us to bind the abstract elements to a concrete protocol – for example SOAP – and specify the URL where the service can be found. Using protocol primitives, the service can be invoked by a client. SOAP for instance is a HTTP-based protocol, specified in an XML-format. Here is a SOAP message invoking the remote `ExecQueryService`:

```
POST /ExecQuery HTTP/1.1   ...            SOAPAction: "ServiceURL"
<SOAP-ENV:Envelope xmlns:SOAPENV=" .. "  SOAP-ENV:encodingStyle= " .. ">
   <SOAP-ENV:Body >  <InQuery> <QueryString>  select ..  </QueryString> </InQuery>
   </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

The response would again be transmitted using SOAP. We could for instance find the following in the SOAP-body: `<OutQuery> <QueryResult> .. DB table .. </QueryResult> </OutQuery>`. The result transmitted in the response is the result of the query – a database table, which could be formatted into HTML.

The *system architecture* consists of a delivery system (with possibly several instructional agents) and the external services. For the development of an interactive Web-based course, we need to distinguish the service implementor or provider and the course developer. The course developer works based on the blackbox behaviour in WSDL given by the service developer. The service user (course developer) needs to understand the behaviour of a service in order to include the service use into the learning process specification. WSDL specifies only names of operations and input/output elements. In an educational context where the teacher has to understand how such a service works, this is insufficient; more semantical and context information is needed.

Conclusions

Knowledge, or content, in Web-based educational systems is not only represented in form of static text and images, knowledge is also represented in form of guided dialogues and dynamic processes within the system. The process of learning is reflected by the student behaviour in the system. Knowledge about this process has to be modelled and implemented adequately. The way different elements are arranged and made accessible is highly important for the success of an educational system.

We have tried to motivate that recent XML-technologies, leading us towards a Web services framework, provide basic notations and technologies for advanced learning technology systems such as active learning environments, but they fall short of addressing page composition, the learning process (course sequencing) and educational contexts for educational services. This applies to all educational systems where different instructional agents and external services have to be integrated in an interoperable framework. We have illustrated concepts for possible extensions of XML-technologies in the XML Protocol context (WSDL, SOAP) for the development and management of such systems, which have to be considered in the development of support technology and standards for educational systems. The potential of the new technologies that we have presented lies in the possibility to implement active learning features and to create Web-based educational systems that allows us to share educational services between courses as a result of an open and interoperable course architecture.

More and more educational systems generate Web representations from basic e-content dynamically, for example assembling various small content units possibly provided by independent services. Adaptive systems are an existing example for this need, where the interface and content made available depend on characteristics of the user. We have already said how important the evaluation of the system usability is. These evaluations can be carried out for individual users. Personalisation and adaptivity are key elements of educational systems. We have neglected these issues, but our concepts enable these technologies through an interoperable systems architecture, which allows to dynamically invoke software tools. Another direction in which future work can be directed is looking at developments summarised under the term 'semantic Web' which shall introduce the notion of ontology to the Web.

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K-12 Professional Development: Facing Technological Innovations

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Abstract: The purpose of this study was to assess and understand the evolving attitudes of K-12 teachers toward instructional technologies they chose to integrate as part of their teaching. Trek 21, a PT3 grant, aims to prepare educators to use and integrate instructional technologies effectively. This study reports and interprets the data collected from the Stages of Concern Questionnaire (SoC), administered to forty-four K-12 teachers who participated in the Trek 21 professional development program for three weeks during the 2000 Summer Institutes. This presentation of results is designed to describe changes in participants' internal and external concerns as they become aware of and attempt to integrate a variety of instructional technologies.

Introduction

K-12 teachers are challenged to select, use, and adopt into practices a plethora of new instructional technologies as current advances in communication technologies improve the wide spread availability of Internet and computer applications in schools. No longer is it an issue of whether these technologies should be used in education. The current emphasis is to ensure their effective use as part of instruction. Teachers are facing increased pressure to learn and adopt instructional technology innovations, not only to prepare the students with the skills they need for the 21st century, but also to promote and enhance higher levels of learning. Teachers must become knowledgeable about available instructional technologies and confident that they can use them to enhance learning. Professional development for teachers is the key issue if teachers are to become agents of change as opposed to being end users. The purpose of professional development is to facilitate the dramatic shift in the way teachers think, deliver, administer, and reassess the way they teach through technologies.

The shift is to happen if K-12 teachers adopt innovations. However, the change for adoption of innovations is a lengthy process that requires a method of knowledge construction, which has direct implications in the teaching and learning environments where technology is truly integrated into the training process. In-service teachers cannot be expected to adopt innovations only because these technologies are available. K-12 teachers need to be assisted to develop new perspectives on instructional design and instructional technology skills in which these approaches are modeled and led by successful training.

Rogers' (1983) theory of adoption and diffusion has been used as the basis for understanding many innovation adoption models. Rogers determined the discrete stages of adoption and diffusion of any innovation in the Innovation-Decision Process Model. According to this model, Rogers described adoption and diffusion as a process passing from first knowledge of an innovation to forming an attitude toward the innovation to adopt in order to implement the new idea by confirming the decision. Rogers also determined that the gap between what is known of an innovation and its diffusion into practice. This requires a lengthy adoption period from the time when innovations become available to when they are widely diffused. Data from the National Center for Educational Statistics (2000) also confirms a lengthy time requirement, three to five years, for the diffusion of instructional technologies into practice.

Resistance to the adoption and diffusion of an innovation is a natural reaction that change creates. Since change is a very personal process, reasons for resistance to change can be many. Not only do teachers need to be patient for a lengthy time while remaining committed to adopt the adoption of instructional technologies, but also they need to be willing to accept the application of these technologies. Understanding teachers, why they accept or resist to adoption of technology, is a critical element that professional developers should consider during the design and delivery of training.

The Study

Trek 21 is a professional development project funded by a PT3 grant from the US Department of Education. Participants of the project include K-12 PDS (Professional Development School) host teachers of West Virginia, faculty from West Virginia University (WVU), and student interns in their 5th year of WVU's teacher preparation program. Trek 21 aims to model appropriate strategies of instructional technology integration during summer institutes and ensures adoption through continues support in the following academic year. This study reports and interprets data collected from the Stages of Concern (SoC) questionnaire, administered to K-12 participants pre, post I, and post II of the Trek 21 2000 summer institutes. SoC, part of the Concern based-adoption model (CBAM), was used to measure and evaluate teachers' attitudes toward the integration of instructional technologies. This model identifies and measures the continuum of seven stages of concern or attitudes teachers may develop when faced with an innovation. The stages are further divided among internal and external concerns. When teachers become more comfortable with the innovation, internal concerns subside. Likewise, an increase in external concerns would be expected toward the end of the instructional period.

Trek 21 Summer 2000 institutes took place over a period three week, after which teachers were expected to post and implement their units during the fall semester. This study looked to understand the evolving attitudes of Trek 21 participants, and assess their degree of adoption of instructional technologies into their practice.

Findings and Conclusion

Five assumptions were laid to establish a foundation for an interpretation. There were (1) the variety of applications and tools that teachers were trained for (2) beginning level of their technology skills (3) duration of training (4) time given to diffuse innovation and (5) a highly personal change in attitudes that each teachers brings along. Based on the above assumptions and the data compiled from the all SoC, the following interpretations were made. Overall, the Trek 21 summer institutes were effective creating a change in teachers attitudes, whose internal concerns decreased in eight of the twelve pre/post institutes. The training addressed participants' internal concerns whereby individual teachers passed from awareness stage and became more personally involved on how instructional technology use changes student and teacher participation. They become more comfortable with using instructional technologies and their anxiety towards innovation and forming an attitude toward adoption decreased. However, the three week training followed by a seven-month support had little impact on external concerns to enable teachers entirely integrate instructional technologies as their external concerns changed insignificantly. This result corresponds to Roger's theory of diffusion and the data from the National Center for Statistics. Although Trek 21 truly modeled a method of knowledge construction through effective teaching and continuous follow ups, technology needs more time to diffuse especially for beginners to instructional technology. Neither is technology a single innovation nor does it take a short time for attitudes to change. Returning K-12 teachers to the Summer Institute 2001 are expected to be more likely to complete the lengthy process in order to externally diffuse the effects of innovations.

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Web-based Support for the Instructional Engineering of E-learning Systems

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Abstract

The rapid evolution of e-learning models increases the number of decisions that have to be made when developing web-based learning systems. ADISA is a web-based system for a project team designing a e-learning system while working on the web. It is based on the MISA method that defines 35 main tasks through which the user produces the design specifications of a learning system, describing knowledge, skills and competencies, learning scenarios, activities and resources, learning materials, and finally, the delivery processes. The innovation in MISA and ADISA is three-fold. a) A key component of ADISA is its object-oriented knowledge modeling approach sustained by a graphic model editor. b) The processes embedded in the method encompass all the dimensions of a telelearning system. c) Software engineering principles are integrated to support systemic design by the project team. The paper describes both the pedagogical and technical aspects of the ADISA system.

1. Principles for instructional engineering

We first define instructional engineering as *a method for the analysis, design, development and delivery planning of computer-based learning systems, integrating concepts, processes and principles of instructional design, software engineering and cognitive modeling.*

There is a growing need for such a methodology because the advances in instructional technologies entail a large set of interrelated decisions to make when we build a telelearning system. What kind of telelearning delivery model or what mix of models do we need? Will we support learners and trainers anywhere, anytime, at any pace? What kind of learning scenarios is useful for a course? Should these scenarios be predefined, propose several learning paths or be learner-constructed? Which actors will interact at delivery time, what are their roles, what resources do they need? What kind of interactivity or collaboration should be included in the system? Will we use a multimedia or a plurimedia approach? How are we to manage the distributed resources? What kind of learning object standards will be used? How can we support interoperability and scalability of the telelearning system? How do we take in account the technological diversity between groups of users within the target population? How can we promote reusability, sustainability and affordability of the web-based learning system we are building?

In light of these questions, instructional design (ID) methodology has a more important role to play than before, but we also need a new generation of ID methods, based on the following principles:

- *Information system approach.* A Telelearning system is an information system, a complex array of software tools, digitized documents and communication services. The artisan-like construction of web based materials and the use of simplistic authoring tools is totally insufficient. Similar to the evolution in software engineering, systematic design processes must support telelearning systems design.
- *Knowledge based design.* The actual emphasis on knowledge management in organizations leads to the recognition of knowledge and higher order skills (competencies) as major training goals, as opposed to simple information acquisition. Knowledge engineering is now a well-established methodology rooted

in AI and expert systems research and practice. Knowledge modeling methods and tools should be at the center of the new ID methodology, in relation to the knowledge management processes.

- *Multi-agent systems.* To be called multi-agent, a system must satisfy four properties [Sycara 1998]. First, the agents, components of the system are situated in one environment. Second, they are autonomous, they control their actions and states. Third, they are adaptive, reacting to change in a flexible way, taking goal-driven initiatives, learning from interactions with other agents. Finally, they are sociable, collaborating and coordinating themselves with users or other software agents. Multi-agent systems offer a good way to model a telelearning system to help define the actors, their functions and roles, and also their interactions as a society of agents.

- *Plurimedia material and macro-design.* A plurimedia material is a set of large grained digitized files delivered on different supports: print, CD-ROMs, DVDs, web servers, etc. The emphasis on fine grained, closely structured multimedia, will decrease as designers prefer to interoperate existing videos, textbooks, courseware materials waiting to be digitized. Instructional engineering shifts the attention from multimedia micro-design to macro-design of learning scenarios integrating plurimedia materials reusing many available corporate documents and tools.

- *Constructivist pedagogy* based on projects, problem solving and process-centered environments is necessary to promote the acquisition of higher skills & competencies, but it is difficult to encompass in an ID method. This can be done by proposing problem/project based scenarios where the learner will need to use analyzing, synthesizing or evaluating skills. Theses processes will, in turn, orient the search for "just-in-time" and situated information instead of "just-in-case information", wasting a lot of time transmitting masses of information to be memorize, understood and applied at a later occasion. Figure 1 compares these two kind of instructional strategies.

Figure 1 – Hierarchy of skills and information

2. Outline of the MISA instructional engineering method

Based on the principles summarized above, we have built, during the past eight years, a new instructional engineering method called MISA. The first version of the method was completed in 1994. It was embedded in a computerized support system for designers called AGD [Paquette et al 1994, 99].

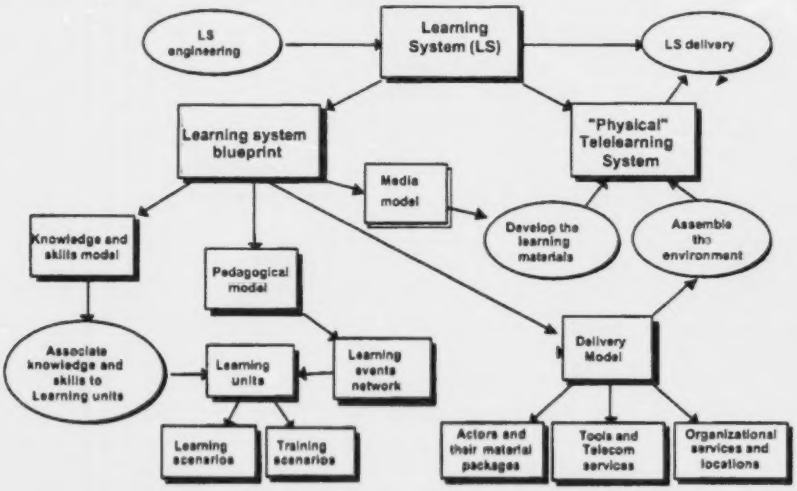

Figure 2 - Learning system engineering concepts

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The MISA instructional engineering method is based on the concept of a learning system presented in figure 2, where ovals represent design processes and rectangles their inputs and outputs. MISA 4.0 helps design a learning system through 35 tasks (shown in table 1) producing 35 main deliverables called documentation elements (DE). The method unfolds through six well-defined phases, the first digit of a task number identifying the phase. Except for the initial phase of instructional problem definition, these phases integrate four blueprints or axis (identified by the second digit): 1-knowledge, 2-pedagogy, 3- materials and 4-delivery. Table 1 shows the content of each of theses four blueprints.

Problem definition		
100 Organization's training system	102 Training objectives 104 Target populations	106 Actual situation 108 Reference documents
Knowledge Blueprint	**Instructional Blueprint**	
210 Knowledge modeling principles 212 Knowledge model 214 Target competencies 310 Learning unit content 410 Learning instrument content 610 Knowledge and comptency management	220 Instructional principles 222 Learning events network 224 Learning units properties 320 Instructional scenarios 322 Learning activities properties 420 Learning instruments properties 620 Actors and group management	
Learning Materials Blueprint	**Delivery Blueprint**	
230 Media principles 330 Development infrastructure 430 Learning materials list 432 Learning materials models 434 Media elements 436 Source documents 630 Learning system and ressource management	240 Delivery principles 242 Cost-benefit analysis 340 Delivery planning 440 Delivery models 442 Actors and user's materials 444 Tools and telecommunication 446 Services and delivery locations 540 Assessment planning 542 Revision decisions log 640 Maintenance and quality management	

Table 1 – Main instructional engineering tasks in the MISA 4.0 method

Similar to software engineering methods, each blueprint starts with the statement of orientation principles. Each of these sets of principles in 210, 220, 230 and 240 are guidelines that the design team establishes to coordinate their work in a coherent way. These principles establish communication between team members, promote goal directed behavior and help in consistency maintenance throughout the design process.

In each of the four axis, a central task is to build one or more graphical models. These models are the backbone of the method. We build a structured view of the target knowledge and skills (212), followed by their distributions into learning units (310) and learning instruments (410). These models are described using a knowledge modeling technique called MOT [Paquette, 1996], where four types of knowledge objects and seven types of links are available to formalizing a model. In the instructional axis, process modeling is used to represent the structure of the learning events at the course or program level (DE 222), as well as the learning scenarios describing the activities in a learning unit (DE 320). In the learning material axis, we model (DE 432) for example a web site or an hypermedia software, showing the media components, their interrelations through hyperlinks, the media templates and the source documents to be displayed in the material. Finally, in the delivery axis, we model (DE 440) the actors, their roles, their interactions, their input resources and their productions.

Most of the other tasks in MISA describe properties of the objects contained in the models of the axis where they belong. For example, we identify target competencies (DE 214) related to objects in the knowledge model. Learning activities (DE 322) and learning instruments (DE 420) are properties of the objects in the learning scenarios. Source documents (DE 436) describes objects in the learning material models and, finally, tools and telecommunication services (DE 444) describe objects in the delivery models.

MISA 4.0 has been redesigned while building a web-based computer system called ADISA, a distributed system for the instructional engineering of learning environments. We will now describe this system.

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3- ADISA – A web-based workbench for instructional engineering

ADISA is a distributed system developed to enhance the performance level of instructional designers, and specifically to assist teams who create Internet-based distance courses or who use sophisticated multimedia technology. This system includes productivity enhancement tools that reduce effort and cost of instructional engineering while maintaining quality consistency and control throughout the various components of a learning system. MOT, an object-oriented knowledge model editor, is a key component of ADISA, making it the first complete knowledge based instructional design tool.

ADISA integrates a large set of educational knowledge embedded including 17 typologies of educational concepts of the MISA 4.0 method integrated menus offering various options to the designers to built some of the DEs. In the case of knowledge models types, a library of models can be made available to the designer as a starting point and later modified in order to adapt to the specifics of the learning situation.

As shown on Figure 3, ADISA is accessible through a Web browser. The left part of the screen gives access to the tools supporting MISA tasks through a table corresponding to the 35 documentation elements of the MISA method. The right part of the screen displays a tool allowing to build the selected documentation element. Here the MOT graphic modeling tool enables the designer to build the Learning Event Network (DE 222) which is a graph representing the structure of a course subdivided here into seven modules or learning units. Other DEs are DHTML forms describing properties of objects in such a model.

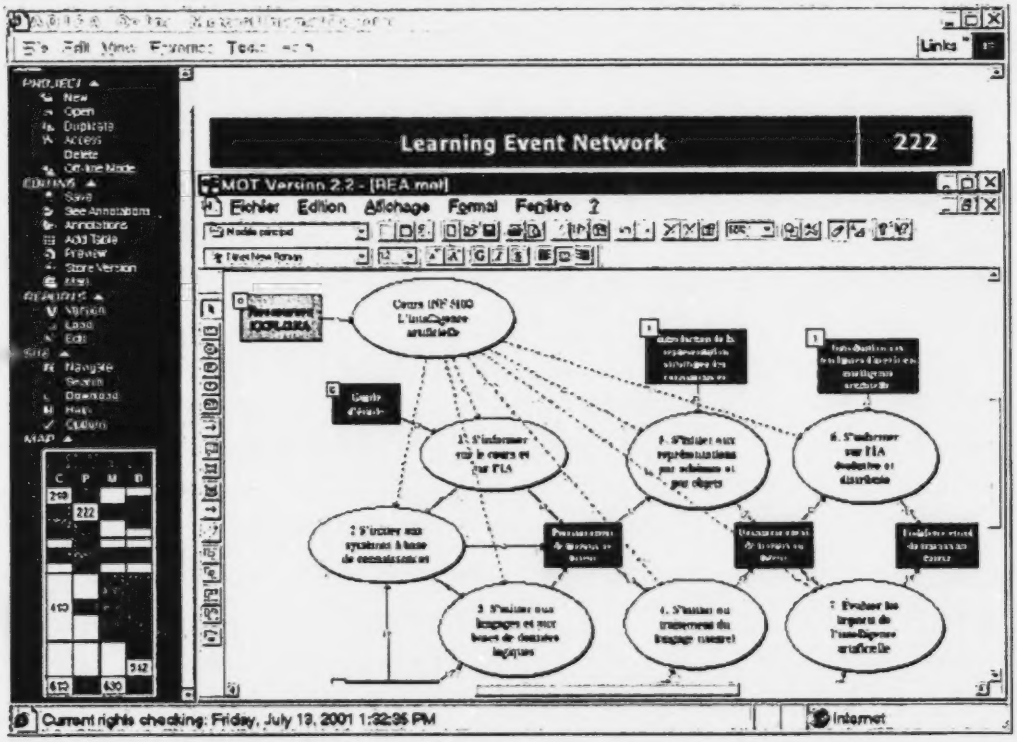
Learning Event Network
222
MOT Version 2.2 - [REA.mot]
Fichier Edition Affichage Format Fenêtre ?
Current rights checking: Friday, July 13, 2001 1:32:35 PM
Internet

Figure 3 – ADISA screen for DE –222 to build the Learning Event Network

Besides the DE card display, the four menus on the left side of the screen give access to ADISA's commands. The *Project* menu allows to create, open, duplicate or delete a design project. It also helps to manage the rights of access, allowing members of a team to work together on various elements of documentation and integrate their work. ADISA is the first instructional engineering system completely on the Internet allowing both online and off-line design specifications stored on either a server or a local disk drive. On and off-line copies are synchronized using the import feature in the Project menu.

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The *Edit* menu offers different options to build the selected DE. One can save it and add to it user defined notes and tables of additional properties. DEs can be marked as completed or validated. A display of the DE can be shown and archived, allowing different versions to be saved for future production of reports.

The *Reports* menu allows to regroup the various versions of the DEs to create reports by phase, by axis, by author or any other criterion chosen by the designer. It helps create the report structure, order its various constituents and print the report.

The *Environment* menu offers a search function operating on the set of DEs (DHTML forms or MOT graphs), a complete on-line help system and some user options. It allows the download of the ADISA structure from the server to a client station for " off-line " work. It finally gives access to a navigation function, accessible through any Web browser, allowing a designer or an external observer to view and annotate the DEs to suggest improvements to the project team, without altering the initial documents

On the technical side, ADISA uses the basic features of Windows and Internet Explorer, especially dynamic HTML forms which modify themselves according to the user's choices. Once saved, DHTML forms, as well as MOT graphic models, are stored as XML files. This method allows the propagation of data between the DEs, an integrated search function for keywords in graphs and forms, as well as the communication with various types of databases and other systems such as authoring tools or learning management systems. The high graphic quality of the workbench provides a global and structured view of the learning objects facilitating the design process. The integration of tools in the workbench avoids the transfer of data, from one tool to another, thus saving time while preventing transcription errors or inconsistencies between related decisions.

4. Data propagation in the workbench

Data saved by the user from a DE form or a MOT model can be passed on to another DE in various ways Figure 4 shows the DHTML form of DE 224, allowing the designer to describe the properties for each of the learning units defined in a learning event network such as the one in Figure 3.

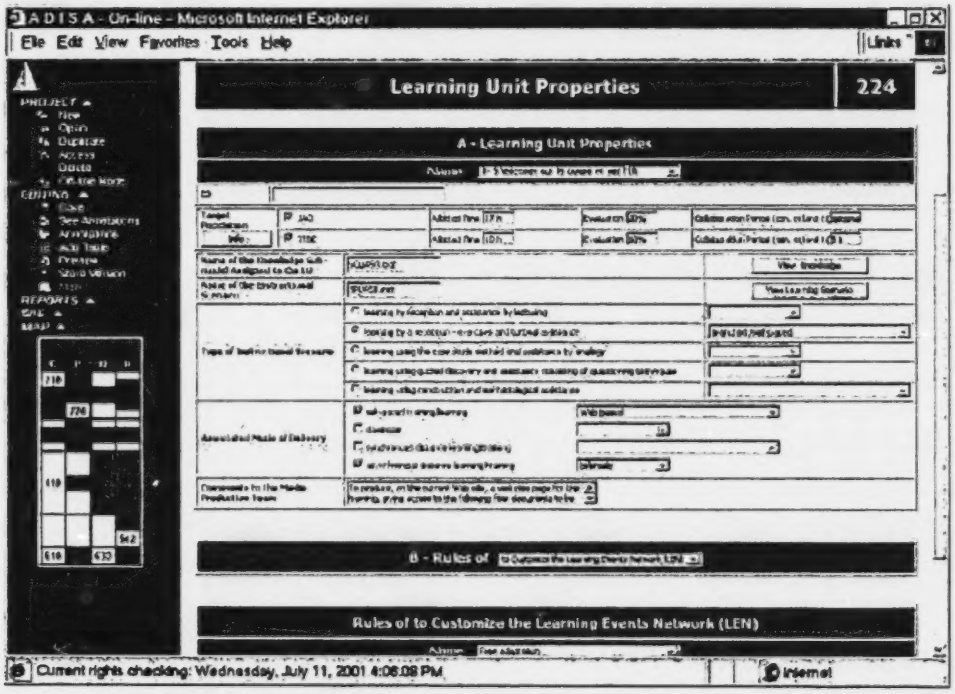
ADISA - On-line - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Links
Learning Unit Properties
224
A - Learning Unit Properties
B - Rules of
Rules of to Customize the Learning Events Network (LEN)
Current rights checking: Wednesday, July 11, 2001 4:08:08 PM
Internet

Figure 4– Example of data propagation to a DHTML form in ADISA

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The first line on this DE 224 form holds the name of the learning unit. It is selected by the designer in a list of learning units read from the XML file saved from the graph constructed in DE 222. It is an example of automatic data propagation between two documentation elements and so are the lines describing target populations of a learning unit. This time, the XML file from DE 104 is read for the names of the target populations; here IAO and ITIE representing students registered in two programs.

Still on figure 4, we illustrate a non-automatic form of propagation. When the graph of the instructional scenario of a learning unit is built in DE 320, it can be displayed in a help window assisting the designer selecting, in DE 224, the type of scenario for this learning unit, for example, the type "tutorial with multiple choice" and "learner controlled pace". This type of propagation helps the designer to check if the graph of the scenario corresponds to its description within DE 224.

ADISA tries to create a balance between automatic propagation of data and the user controlled propagation. Automatic propagation is convenient, because the user does not have to re-enter data already created in another DE. Without the automatic propagation, the use of the method would be too often tedious. On the other hand automatic propagation implies more difficult teamwork, because of the possible conflicts between two designers, one working to change data on which the other one bases himself to build another DE. This situation would then force designers to work in a sequential manner rather than in parallel, which might not be ideal.

Furthermore in many cases, automatic propagation is not desirable when one user is placed to make the best choices. For example, an important task of the design method consists in regrouping all the instruments appearing in the learning units, in a certain number of learning materials. The Content Expert is best placed to this task.

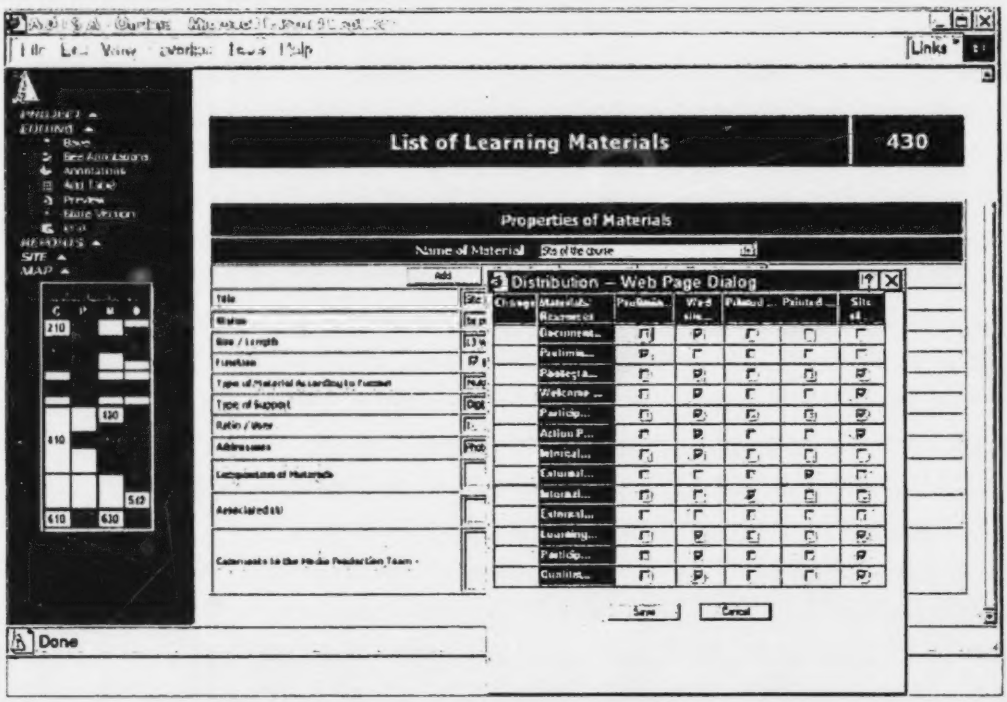

Figure 5 – Data propagation organized to support the designer's decisions

To help the designer in this task, ADISA supplies a table illustrated on figure 5. Here, the system regroups instruments appearing in instructional scenarios (DE 320) and lists them as rows of the table. Columns represent the materials to be built, defined in DE 430. The interface on figure 5 allow the designer to decide which instruments will be regrouped and whether put on to one or several formats forming different types of material packages, just by checking the corresponding cells.

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If another designer, working on a scenario in DE 320 decides to change the instruments serving as inputs to some of the activities, these changes will be announced to the designer in figure 5, so that s/he can interact with this colleague and complete the task while keeping the overall blueprint consistent.

Conclusion

In summary, ADISA is a sophisticated set of tools linked together to address, if needed, the full complexity of instructional engineering. In most cases, a team of designers will use only a part of the system but the interrelations between DEs is always made available in the integrated help system and by alerts when a task needs a previous one to be completed.

To keep the system as flexible as possible, while giving essential support to a team of designers, we have design three kinds of data propagation between instructional engineering tasks.

- *Automatic propagation* is done by the system without user intervention, information in a source DE is transmitted to a target DE to be displayed in some fields of its DHTML form.
- *Source propagation* consists in transmitting information from on or more sources in some DEs to a target DE where the user will select the information to be integrated in this DE.
- *Information propagation* simply displays information from a source DE that is particularly useful to build a target DE, the user remaining free to use this information or not.

ADISA is the first general instructional design support system solidly rooted in educational research, in knowledge engineering as well as software engineering principles. Further more, in all the 35 documentation elements (DE), the corresponding tools output learning objects description as XML files, thus providing an extensive set of meta-data that can be used for interoperability. This metadata is compliant with the ongoing efforts to create international standards such as IMS, IEEE, ARIADNE, AICC, SCORM or CANCORE.

Work is on-going at the LICEF research center and its associated company, Cogigraph Technology, to link ADISA to web based material production tools and delivery platforms for distance education. Meanwhile, the method and the tools are being applied in a number of projects and organizations for the design of e-learning environments.

Aknowledgement

The ADISA system has been developed under two research contracts from the Canadian defense industrial research program. Recent work on the MISA method has been financially supported by the Telelearning network of centers of excellence (TL-NCE) of which LICEF is a founding member

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Senior Citizens and Computers: You CAN teach an old dog new tricks!

Richard Pare, University of Maine, USA

Senior Citizens and Computers: You CAN teach an old dog new tricks! Help is given to seniors living in Senior Citizen Housing with reference to setting up their computers and then teaching them the basics of word processing, and connecting to the internet. No need for seniors to feel alone with the World Wide Web available. They can now e-mail, surf the net, join chat rooms, and even talk to family and friends without those expensive phone bills.

Personalized Content Recommender System using a Hybrid Filtering Technique

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Abstract: In this paper, we present a method of system implementation for personalized content recommendations. For better recommendation performance, we first suggest a refined user profile structure and a new hybrid filtering technique related with the profile structure. And on the basis of this methodology, we implement a recommender system where user preferable contents can be adaptively recommended at the right time during a user's live interaction. We show an evaluation of the proposed approach on a real database of a webcasting site.

1. Introduction

Recently, the tremendous growth of information on the internet leads to the development of more intelligent search methods, especially finding information relevant to a user's interests. We call the joined process of finding and providing user preferable content as *personalization* [1]. On-line shopping stores, such as the Amazon or the CDNow, deal with a number of items and try to recommend personalized books or CDs by using a recommender system. A *recommender system* is that try to suggest fast discovery of user preferable contents to individuals. With this personalization, we get more meaningful user responses, which result in a new profit from the interactions.

The issue of personalized content recommendation is how to find user interests efficiently from their behaviors or the opinions of similar users, which decides the quality of a recommendation service ([2]~[5]). Basically, the two fundamental techniques - Content-based filtering and Collaborative filtering [3][4] - can be used separately or together. Content-based filtering uses content information itself to find user interests. In this method, contents which have similar characteristics with those user has experienced past can be recommended. It is so simple, but recommendations can be restricted for various contents because of the deficiency of a user's various experiences. Collaborative filtering predicts the user likeness for contents on the basis of other users' numerical ratings for those contents. This collaborative filtering is still dominant in existing recommender systems and complements the weaknesses of content-based approach. But it also has some limitations of sparsity and scalability problems [4][6]. To solve the problems of both filtering methods, we adopt a new *hybrid filtering technique* that takes the advantages of both methods while tries to eliminate the weaknesses of each of them.

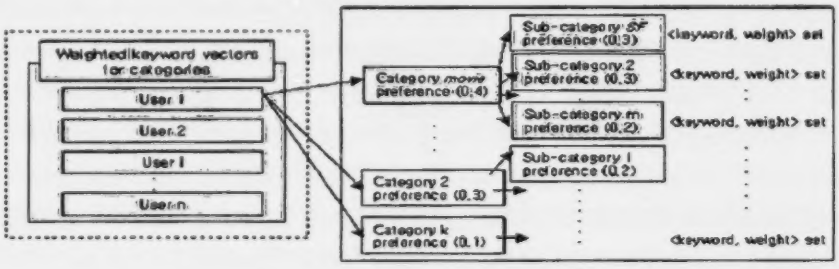

Figure 1. User Profile Structure.

2. User Profile Structure

In our recommender system, we use a user profile structure stemmed from the expression of weighted keyword vector [7], which would be the main source in a learning process. As shown in the Figure 1, a user profile is

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represented as a hierarchical structure that is categorized by content features (i.e. genre for movie category). The user profile consists of a set of *<category, keyword, weight>* pairs for each category hierarchically, which reflects the preferable *keyword* and its degree *weight* for user likeness in the *category*.
This expansion of a profile expression enables the recommender system not only to adopt the suggesting hybrid method but also to recommend adaptively a content reflecting the position where a user is located on the web site. In the figure, the sum of preferences at each category level is 1 and each preference value represents user preference for the category. (i.e. a user's movie category preference = 0.4 and movie SF genre preference = 0.3)

3. Hybrid Approach to Content Recommendation

We take the hybrid method into account with the user profile structure described. Our approach is distinctive in the way of combining each filtering feature. It takes content-based features with the selecting factor α ($0<\alpha<1$)? determined by the degree of contribution of a user's feedback information and demographic information. The feedback information involves user behaviors during a interaction and can be obtained as with the *relevance feedback* process in the *Fab system* (Marko Balabanovic and Yoav Shoham. 1997). Then, collaborative features of $(1-\alpha)$ factor are used in a learning process and we get a final recommendation list that is hierarchically categorized and complemented. Roughly, the hybrid features in a learning process can be expressed by the function *f*.

Hybrid *f*(α,<user profile>, <user feedbacks>,<group profile>)
.Hybrid *f*(α,<user preference>, <user feedbacks>,<group similarity>)
.> {*<category, keyword, weight>* set}

The recommendation service itself can be partitioned into two parts. When a user logged in a web site, the system extracts user recommendation information and applies some business rules (i.e. a targeted commercial advertisement in the corresponded category) to the recommendation list generated by a learning process. And in the next stage, as the user moves around the web site, the system recommends user preferable contents depending on the user's position. That is, location adaptive recommendation is possible in our system since we already made the user profile and recommendation list hierarchically so as to reflect the structure of the web site.

4. Performance Evaluation

Currently, we have been performing the experimental evaluation using our real data set to show the effect of our hybrid filtering method. The data consist of 16,732 contents and 79,975 users from the 'Hanmir' web site (www.hanmir.com) and those contents are especially concerned with the web casting service. We select frequent users who have visited and used pay contents repeatedly. This data set shows whether the system works well or not in the case that just content-based features are used more than that of collaborative features. 13,960 feedback records from the frequent users were used in the learning process. The prediction results show that over 12 percent of recommendations were corresponded to the test set when 80 percent of the data set was used as a training set. Currently, we are applying all of the proposed technique to the recommendation. We'll show experimental results performed by the hybrid method in the final report. The results will also include the ratio of the number of the recommendation by our method to the number of the contents seen by the users.

5. Concluding Remarks

In this paper, we have presented the hybrid content personalization techniques with the refined profile structure. With this system, user location adaptive recommendation is possible and service providers can get more profits by performing the relationship marketing.

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Web Facilitated Weather

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Weather is an important curriculum component at Embry Riddle Aeronautical University since it is a significant factor in aviation. Instructional use of the web is also an important component of ERAU instruction. As part of a comprehensive study of WBI development and deployment, a web facilitated version of a basic meteorology course was studied. Web elements were created to organize, introduce, emphasize, and support existing textbook and CD ROM content. The web facilitated course was designed to reduce or eliminate face-to-face class sessions.

MANAGING DIDACTIC DECISIONS IN COURSEWARE DEVELOPMENT: A PRELIMINARY PRESENTATION OF ONGOING RESEARCH CONTRASTING EXPERIENCED AND INEXPERIENCED TEACHERS.

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Abstract: This short paper reports on an ongoing study of the ways teachers make decisions when having to select, organise and manage didactic content for the purpose of planning courses using a courseware tool. These processes are being analysed in terms of differences between experienced and inexperienced teachers, at the didactic decision level itself, considering the subjects' epistemic beliefs towards knowledge and also their attitudes towards computers and technology. No hard results are put forward due to the early stage the study is in at the present moment, although perceived tendencies can already be envisaged.

INTRODUCTION

If we confine ourselves to the Portuguese context as to research conducted within the domain of courseware and educational multimedia development and of the full integration of these tools, studies tend to centre their efforts around a single strand of the educational phenomenon – that of the learner/learning dichotomy. In such studies, issues like learning gains, effectiveness and efficacy of transfer of acquired knowledge to novel situations by means of these tools, and a recurrent valuing of the learning theories that underlie the conception of such tools are often mentioned as important (Moreira, 1996); (Jacobson *et al.*, 1995); (Spiro *et al.*, 1991); (Carvalho, 1998).

Research questions we try to find answers for are: "How do teachers select, organise and manage content for didactic use when they recur to ICT (namely using cognitive flexibility hypermedia prototypes)?"; "Are there patterns of didactic decision for these processes when using ICT?"; "How are these decisions affected by teachers' epistemic beliefs and attitudes towards ICT and their levels of experience?"

BRIEF THEORICAL CONTEXTUALISATION

One cannot deny that learning hypermedia environments are a powerful metaphor for the multidimensionality and complexity of the world and that of knowledge. There is therefore a need to understand how teachers respond to the ever growing potential of technology for their profession and how they use it for teaching (Dias et al., 1998).

There is increasing reference to the need to design content that these technologies can render as true teaching instruments. This presupposes, on the part of teachers, a will to question their teaching practices. It is not enough for teachers to confine to linearly transferring knowledge to this new environment and, therefore, to the learners; they have also to guide them in their own search for information, equating and interrelating it, being critical thinkers in the process of designing content in ICT for education (MSI, 1997).

THE ONGOING RESEARCH

Focussing on the issue under study, it is necessary that the knowledge domain be cut up into small fragments of information and that these are analysed from conceptually relevant perspectives. This process of deconstruction of knowledge on the part of the teacher will allow for its acquisition in a meaningful, case-based

and context-dependent manner, fostering the development of cognitive flexibility and thus rendering the learner better able to tackle novel situations of a similar conceptual nature, allowing for transfer (Carvalho, 1999).

Hypertext environments are extremely good candidates for the promotion of cognitive flexibility (Spiro et al, 1988) in ill-structured knowledge domains. The need for swift rearrangement of sequences of instruction that permit "on the fly" multiple representational dimensions of knowledge, constitute the requisites of characteristics found in the properties of hypertext systems. These facilitate restructuring teaching sequences, multiple coding of data and multiple links between content components.

This requires a change in the role of teachers – from conveying knowledge to facilitating comprehension. At the same time it requires a fundamental shift in the evaluation tradition in which the focus is ascribed to the individual cognitive development and knowledge transfer for application.

The present study aims at understanding how teachers perform this role, namely in selecting, organising/structuring and managing contents in the planning activity, in itself a complex and ill-structured task.

For that purpose teachers in the study will use DIDAKTOS (Didactic Instructional Design for the Acquisition of Knowledge and Transfer to Other Situations), a Cognitive Flexibility Hypermedia programme developed by Moreira, Almeida and Raposo (2000).

This planning activity will be compared with obtained results in questionnaires of "Epistemic Teaching Preferences" (ETP), with an "Attitudes toward computers and technology" (ATCT) questionnaire and with their experience level. With the first questionnaire we try to reach the subjects' opinions about the way they face teaching and knowledge while in the second one we try to capture their attitudes towards computers and technology (taken in their daily use).

We put forward several research hypotheses, that we will try to check: a) Subjects that in the ETP questionnaire are characterized as possessing a flexible profile, independently of their experience level (i.e., they value complexity and holism in teaching practices and knowledge) will present, at a didactic planning level, more efficiency; b) Subjects that in the ETP questionnaire are characterized as possessing a linear profile, independently of their experience level (i.e., they value rigidity and algorithms in teaching practices and knowledge) will present, at a didactic planning level, less efficiency; c) Experienced subjects (at the practice level) will present more efficiency in planning; d) Not experienced subjects (at the practice level) will present less efficiency in planning; e) Subjects that have more favourable attitudes in the ATCT questionnaire, will present more efficiency at a didactic planning level; f) Subjects that have less favourable attitudes in the ATCT questionnaire will present less efficiency at a didactic planning level;

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Designing and Developing in a low-bandwidth environment using high-bandwidth solutions: the "hybrid" approach

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This presentation describes the production of a web-based training product that uses interactivity tools, tracking systems, video clips, and animated characters, in an environment with serious bandwidth constraints and limitations. A "hybrid" approach was used, with contents distributed on a web server and CD-Rom. This presentation will include a description of the initial situation, an account of the different possibilities explored, and a discussion of the solution developed.

DILE: A system to design electronic books

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Hector Jorge GarciaNeder, National Technological University, Argentina ; Luis VilanCrespo,
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In this article we present the principles of the didactic tool you DILE, designed to create electronic books. DILE it is being developed to be multi-user, distributed, scalable and dynamic, allowing in all moment any alteration type or amplification on the part of the generating user and it is being implemented entirely in Java. The structure of the electronic book will be generated the most similar thing, hierarchically, to a conventional book, but it will incorporate all those tools useful multimedia for the learning: videotape, image, sound, etc.

SENEKA - Service Networks for Training and Continuing Education

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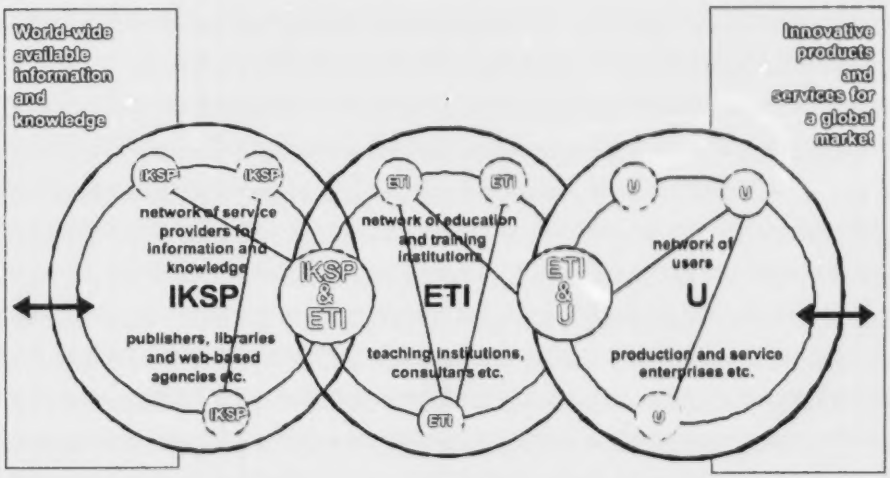
SENEKA is part of a project framework: „Utilizing the world-wide available information and knowledge for training and further education and innovative processes" initiated by the German Federal Ministry of Research and Education (BMBF)

Coodination:
Department of Computer Science in Mechanical Engineering (IMA) and Centre for Research and Development in Higher Education (HDZ) in co-operation with
agiplan ProjectManagement GmbH

SENEKA aims at making world-wide available knowledge more effectively usable for business across Germany, in particular for small- and medium-sized enterprises (SME). Therefore, a main focus of SENEKA is to establish networks of information services, educational institutions and users in order to promote and support innovation of products and services.



Currently 26 enterprises of most different lines of business and 6 research institutes participate in the project.
In order to improve the learning process within the network, the Virtual Platform was introduced in summer 2000.

Example 1:
The Virtual Platform is a webbased tool that allows learning, communication and document management. All participants have individual logins, that give special rights and make linkages to relevant contents. E-mail, documents notes etc. can be delivered or provided controlled by ist content or targeted to users / usergroups. Within 1 ½ year change from paper based work to e-based networking can be ascertained. This was possible, because several meetings and co-operation through the years had laid a strong base of confidence to eachother in the project.

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(three minutes demonstration)

Example 2:
W.I.R. – Webbased Information Room ist the approach of one of the partners in SENEKA to secure critical processes that make extensive use knowledge. In the first step internal processes of the consulting company are supported by W.I.R..
Information, examples and documents are provided along the workflow in three dimensions:
- products and services
- clients
- lines of business.

W:I:R: is used for:
- training of new employees / consultants
- standardizing the workflow
- continuing training relevant projects of the consulting company.

W.I.R. is a learning tool. All new documents are automatically linked to information, examples and documents that where used in the process of the creation of the new document.
(three minutes demonstration)

The examples given are tools to improve the knowledge of the user. Of course this tools ars not stand alone solutions. In parallel to the Virtual Plattform an project team is coordinating all activities within the project. Additionally meeting with several groups or the whole consortium are held at least two times a year.
Conclusio: E-learning can work properly, if the social aspects of communication and learning are covered.

Caught in the Net:
Undergraduate On-line Instruction for Science and Non-science Majors.

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Abstract: This paper will identify the relationships between the availability of sources of information on a primarily undergraduate college campus, and undergraduate's self-efficacy for instructional and research activities conducted through the Internet, specifically in science and nonscience courses using the Blackboard courseware environment. A model has emerged to increase the effectiveness of undergraduate Internet use in on-line classroom instruction and research required for those classes. This model attempts to distinguish how the quality of teaching and learning changes with the use of Internet resources due to the significant differences in computer self-efficacy between science and non-science majors and the unique characteristics of the Web: interactivity, immediacy, networkability, information quality, and directness; and the web-based Blackboard environment in which activities occur.

Background

There is little research to tell us who may or may not use the Internet successfully in the process of instruction (Poole, 2000). Bandura (1986) identified four sources of information in learning environments that participants use to judge self-efficacy: previous experience through performance exposure and self- instructed performance; vicarious learning through live or symbolic modeling; verbal persuasion through suggestion, exhortation, or interpretation; and physiological arousal, which contributes to strength and vulnerability (p.126). This paper will identify the relationships between the availability of sources of information on a primarily undergraduate college campus, and undergraduate's self-efficacy for instructional and research activities conducted through the Internet, specifically in science and nonscience courses using the Blackboard courseware environment. The basic differences between the courses discussed here are:

- **Earth System Science On-line (ESSO)** is a course developed by the Classroom of the Future at Wheeling Jesuit University in Wheeling West Virginia and offered nationally through several universities to elementary and secondary school teachers. This course has been designed for a sixteen week semester with excellent graphics, highly defined readings, group assignments with discussion of the results, and general assessment rubrics. It is highly directed yet emphasizes the best characteristics of problem based learning:1. presentation of a specific well defined problem; 2. description of what is known from a review of research; 3.activation of prior knowledge through group discussion; and 4.identification of information needed to understand practical problem.

- **Foundations of Education (FE)** is a course which is offered by most Education Departments with undergraduate degree programs. Some of the text's (McNergney and Herbert, 2000) accompanying web-based materials have been uploaded (with permission) to Blackboard along with other resources that students will be using throughout the course. Students are allowed to pace their reading and assessment through online quizzes and can be fairly self directed as to how they attack the assignments with specific assessment rubrics. This course emphasizes the best characteristics of inquiry based learning: 1.involvement of students in instructional activities both online and on campus; 2.presentation of key questions through three strategies – identification, clarification, and interpretation; 3. activation of prior knowledge through group discussion; and 4.identification of sources of information available to support exploration of solutions.

Description of the Model

A model has emerged which attempts to distinguish how the quality of teaching and learning changes with the use of Internet resources due to the significant differences in computer self-efficacy between science and non-science majors and the unique characteristics of the Web: interactivity, immediacy, networkability, information quality, and directness; and the web-based Blackboard environment in which activities occur. The model we visualize in Figure 1. requires the instructor to understand that undergraduates in science and nonscience academic majors relate to sources of information differently (Shatkin, 1998). Figure 2 shows that science majors plan how they work, they form a system and this process shapes the student's beliefs about his/her own ability to perform a task on the Internet – their computer efficacy beliefs which determine the behaviors that result in successful outcomes.

Person ? **Behavior**

Efficacy Beliefs:

?

Factors in the Learning Environment

Internet Access	Peer Interaction	Faculty Feedback
Time	**Strength**	Support
	Previous Computer Experience	

?

Instructional tasks performed on the Internet

E-mail	Database searching	WWW "surfing"
Graphic representation	**Generality**	Data manipulation
	Report Production	

?

Academic Discipline Research Protocol

Problem Definition	Location of Resources	Selection of Resources
Record Relevant Information	**Magnitude**	Analyzing Information
	Synthesizing Information	

Figure 1. Model of the impact of undergraduate computer self-efficacy on Blackboard based Instruction.

	Science Major			NonScience Major		
*	L/H	M	SD	L/H	M	SD
Total Learning Environment	26/56	41.25	6.48	26/56	41.40	6.08
Hours spent	1/5	3.41	1.23	1/5	3.41	1.28
Exhibit Manual Dexterity	1/5	3.98	.91	1/5	3.70	1.27
Exhibit 3-dimensional Visualization	1/5	4.00	.96	1/5	3.55	1.29
Work Well Under Pressure	1/5	3.89	1.14	1/5	3.86	1.24
Like To Know How Things Work	1/5	4.18	1.12	1/5	4.16	1.09
Like To Organize Objects	1/5	4.25	.83	1/5	4.00	1.16
Like to Plan How to Perform Activities	1/5	4.04	1.08	1/5	4.04	1.14
Like To Develop A System For Performing An Activity	1/5	4.02	1.03	1/5	3.82	1.17
Recover From Errors Easily	1/5	3.54	1.13	1/5	3.38	1.22

Figure 2 Sample Description Statistics (n=30)

The authors have investigated the sources of information in the learning environment, the academic discipline, and the Internet tasks themselves that may shape computer efficacy beliefs and learner success (Fig. 3). With the lack of visual and verbal cues in the learning environment of both courses, organizational issues preoccupy students. They resist the idea that the class does not physically meet, that they must use a "professional" or standard university e-mail account, and that they must question directions which may not be very explicit. Consequently, students need more time to organize themselves to complete group assignments.

While it was hoped that a student moderator would take control of groups in either course, providing the intellectual impetus and ideological framework (Tagg, 1994) from which

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peer interaction would progress, this did not happen. Assessment criteria and faculty feedback, regardless of course or major seem to be the most important source of information for the student.

	Science Major			NonScience Major		
*	L/H	M	SD	L/H	M	SD
Total Computer Self-efficacy	30/143	82.82	27.54	30/143	75.02	25.22
Total Conversation Self-efficacy	7/40	28.55	7.21	8/40	25.99	8.54
email self-efficacy	1/5	4.61	.80	1/5	4.28	1.24
thread self-efficacy	1/5	3.17	1.46	1/5	2.98	1.53
filter self-efficacy	1/5	3.24	1.50	1/5	3.34	1.55
address self-efficacy	1/5	4.01	1.16	1/5	3.81	1.45
attachment self-efficacy	1/5	4.02	1.32	1/5	3.44	1.54
mailgroup self-efficacy	1/5	3.03	1.59	1/5	2.83	1.62
chat self-efficacy	1/5	3.24	1.59	1/5	2.58	1.67
Total Data Creation Self-efficacy	8/35	17.32	7.48	8/35	16.02	5.42
Total Data Conversion Self-efficacy	8/40	22.91	12.21	8/40	20.04	11.36
Total Data Distribution Self-efficacy	6/30	14.03	7.91	6/30	13.83	7.20

*Abreviations: L/H = Low/High Score; M=Mean; SD=standard deviation
Scale: 1= Strongly Disagree 2= Slightly Disagree 3= Disagree 4= Agree 5= Strongly Agree

Figure 3. Sample Description Statistics (n=30)

While data creation, conversion, and distribution show significant differences between science and nonscience majors, the difference is so small that for our purpose there is no practical difference. Electronic conversations however do show significant statistical and practical differences. E-mail is the easiest for all majors, uploading and downloading attachments more difficult for nonscience majors. Students seem to be less willing to critically review each other's work. In ESSO students do not appear to have command of a vocabulary that will allow them to express constructive comments without appearing to be less in control of the facts. In FE the fear is that they will be viewed as rude or disrespectful. While a command of factual information was required for threaded discussions in both courses, the more lively expression of

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opinion occurred in the FE course where controversial U.S. Supreme Court cases were referenced.

Finally the discipline's research protocol has a decided influence on the successful outcome for each major. Science majors have little trouble defining the problem to be solved in ESSO and recording the relevant data on a spreadsheet or representing it graphically; the generality dimension is evident. Analysis and synthesis of the selected information is still a challenge for both types of major in both courses indicating the small magnitude of their computer efficacy.

When the idea of taking an on-line course is initially introduced with undergraduates there are two reactions: "This will be easy because I won't have to go to class"; or "I'm not getting my money's worth because you won't physically be in class with me every class meeting". The students soon realize that the on-line course is more work because no single source of information limits their search for solutions and they have to write clearly in order for their solution to be understood. They are not simply reacting to knowledge, they are constructing it.

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Utilising Landmarks for Web Site Navigation

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Abstract: The World Wide Web is commonly regarded as a global information space. Many researchers have linked this concept of an information space with the psychology of physical navigation including the application of navigational notions of wayfinding, exploration and recognition of landmarks. Much research has pursued the issues relating to the development of web interfaces to support wayfinding and exploration however little has addressed the notion of landmarks, their identification and the interface design issues. This paper examines the application of theories of physical navigation to the WWW particularly the concept of landmarks then presents an implementation of a site map system demonstrating the utility of landmark identification to web site navigation. This 'SiteTree' system displays a hierarchical abstraction of the site, which provides basic filtering and visualisation controls, including novel "landmark" functionality.

Introduction

Disorientation and the WWW

Pre-web hypertext research has identified a variety of orientation and navigational problems as major usability issues. The experience of being disoriented within a hypertext system such as the WWW continues to exist as one of the major problems frustrating both users and developers. Researchers have defined this problem as "the tendency to lose one's sense of location and direction in a non-linear document" (Bieber et al, 1997) and have granted it a modern day colloquial title of "Lost in Hyperspace" (Halasz, 1988; Nielsen, 1990). The symptoms of the 'lost in hyperspace' syndrome are "where users cannot get an overview, cannot find specific information, stumble over the same information again and again, cannot identify new and outdated information, cannot find out how much information there is on a given topic and how much of it has been seen, etc" (Gershon, 1995).

Disorientation may be best understood by examining the decision making process of whilst interacting with a hypertext system. This process focuses on the decision of which node to view next but also involves a variety of elements which have been described by various researchers:

- Knowing where you are in the network and how to get to some other place that you know (or think) exists in the network (Conklin, 1987)
- Understanding one's current location in the network, selecting potentially useful routes and executing the selected routes (Kim & Hirtle, 1995)
- Where am I and where do I want to go? (Wright & Lickorish, 1994)

Given the nature of these dilemmas, it is not surprising that many researchers draw parallels between navigating in physical environments with the task of navigating through hypertext systems such as the World Wide Web (Cunliffe et al, 1997; Benyon & Hook, 1997). Already many web site interfaces employ metaphorical references to direction, path, maps, footsteps and landmarks all of which are related to navigation through a physical environment. Some systems heighten the level of the metaphorical experience by embedding the user in a 'virtual worlds' of libraries, shopping malls and museums (Kim & Hirtle, 1995). This strong connection with

physical navigation has dominated the interface design of information retrieval systems and has entrenched itself into the psyche of users and hence will be resilient to change.

WWW Site Maps

Disorientation is a problem that may never be solved as it is the cost aspect of a trade-off between greater flexibility in access (Kerr, 1995) and the vast amount of information available through the Web. The problem however may be managed through the provision of tools that minimise the cognitive load of the task of navigation.

One of the most common web site navigational tools is the 'Site Map'. Site maps provide a graphical representation of the system topology assisting users in orienting themselves within the global information space as well as providing a detailed sense of location within the neighbourhood of the current node (Neilsen, 1990). They are essentially maps of the underlying information space allowing users to see where they are, what other information is available and how to access other information (Mukherjea & Foley, 1995).

Site maps are similar in nature to overview maps, overview diagrams or context diagrams that have been used as navigational aids in traditional hypertext systems (Conklin, 1987). The application of existing overview maps technology to the World Wide Web was to be expected "since we humans have used maps to navigate our way across oceans, through cities and around shopping malls for millennia, mapping our Web sites seems natural." (Morville, 1996).

It has been proposed that site maps support the user in the task of navigating through hypertext by allowing them to generate an appropriate mental model of how the information space is structured (Simpson, 1990; Gray, 1990). Mental models are cognitive mechanisms that are dynamically created through experience as people interact with others and their environment (Norman, 1988) allowing predictions to be made about events before carrying out actions. There is evidence to suggest that an appropriate mental model can improve a user's ability to interact with a system (Rumelhart & Norman, 1981) especially with regards to hypertext systems (Campagnoni & Ehrich, 1990).

Clear and informative site maps help users understand the structure of hypertext systems however constructing effective site maps is a challenging task (Mukherjea & Foley, 1995). Conklin (1987) suggests that large and complex hypertext networks make it difficult to overcome disorientation problems with overview maps because of parameters such as large number of nodes, large number of links, frequent changes in the network, slow or awkward response to user control inputs and non-visually oriented users. These observations are particularly relevant to the World Wide Web particularly considering the size, complexity and distributed ownership of the information available. Further, Morville (1996) warns of the risks of using overview maps as a "bubble gum" approach to fixing poor site design, and Bieber et al (1997) comment on the problems of navigating overview maps themselves especially when they are large or complex. These issues present challenges for the design and implementation of site map tools that unless addressed will result in an ineffective tool.

Reducing complexity

There are a variety of visualisation techniques that can reduce the complexity in sitemaps in order to facilitate usability. Several key techniques for controlling complexity in large visual information systems including distortion and thresholding have been proposed by Leung (1996).

Distortion techniques provide users with both a local and global view of the information space (Lamping et al, 1995; Pilgrim & Leung, 1996) and include the use of zooming, split screens, magnifying glasses, and distortion oriented displays such as fisheye lenses and bifocal displays.

Thresholding presentations provide a systematic way of suppressing or revealing the information to be presented, reducing screen clutter and complexity. World Wide Web site maps, particularly those that are created automatically, usually display the structure of the site in its totality, creating an extremely complex view. These complex representations do little to help the user orient themselves within the site and usually suffer from navigation problems themselves. Dynamic filtering tools when applied to site maps may allow the user to control the level of structure to be viewed thus providing a scalable representation of the site supporting the generation of an appropriate mental model and the overall navigation decision-making process. Filters may readily be applied to a limited number of web page attributes such as size, date and level in order to control the visibility of nodes in a site map. Such filters are generally simplistic and do not result in alternative views of a site map that would provide useful insights.

The World Wide Web is commonly regarded as a global information space. Many researchers have linked this concept of an information space with the psychology of physical navigation including the application of navigational notions of wayfinding, exploration and the identification of important landmarks. This paper examines the application of theories of physical navigation to the WWW and presents the concept of landmarks as an effective method of implementing filtering on WWW Site Maps.

Physical Navigation

The Psychology of Navigation

Research suggests that users build a spatial cognitive representation of the structure of hypertext systems whilst navigating (Edwards & Hardman, 1989; Kim & Hirtle, 1995, Rivers & Storrs, 1985). This indicates an analogy between physical navigation and navigation of information spaces. Cognitive psychologists Siegel and White (1975) have proposed a development sequence of cognitive representation that, as we become increasingly familiar with a geographical environment the nature of our knowledge progresses through three levels of maturity:

(a) Landmark knowledge – where travellers orient themselves exclusively by highly visual landmarks. This knowledge is characterised in terms of actual visual images of landmarks allowing them to be used as "course-maintaining aids" (Cohen & Schuepfer, 1980) hence the common practise of placing highly salient landmarks at intermittent locations in the design of cities. This could be extended to include landmarks at regular intervals in any hypertext system since they provide the skeletal frame of reference from which the two subsequent phases of learning may be achieved (Anderson, 1979).

(b) Route Knowledge – this level of understanding is characterised by the ability to navigate from one spot to another, utilising landmarks or other visual features to trigger the decisions to turn left, turn right or go straight at intersections (Wickens, 1992). Route knowledge is essentially sequence knowledge (Siegel & White, 1975) based on the self as the frame of reference. It possesses a degree of spatial awareness but is essentially visual requiring users to make navigational decisions based upon what they can see from their current position.

(c) Survey Knowledge – characterised as an internalised "cognitive map" of the structure of the environment. This knowledge provides the user with the ability to describe the relative locations of two landmarks in a city even though they may never have travelled a route connecting them. It is based on a world frame of reference independent of current location and view (Wickens, 1992).

Edwards & Hardman (1989) also suggest that whilst navigating, users build cognitive representations of the environment in four stages: 1. landmarks 2. route maps 3. mini-maps 4. survey maps. Their research indicates the analogy between data navigation and physical navigation and the advantages that this brings to the user through the ability to work out shortcuts and recover from navigation errors. Their distinction between mini-maps and survey maps indicates a learning process where mini-maps are incomplete, inconsistent and may be distorted with respect to each other (Benyon & Hook, 1997).

Web Site Landmarks

The parallels between physical navigation and navigation of information spaces have been a factor in the development of site maps as popular web site navigation tools. Site maps provide a representation of the structure of a web site that would assist the user in gaining high-level survey knowledge allowing sophisticated navigational strategies to be employed. However it has been established that site maps themselves suffer from navigational problems particularly those that attempt to display the entire detail of the site.

A number of researchers have suggested a variety of visualisation and filtering methods to reduce the complexity and simplify the navigational decisions for the user. The notion of landmarks provides a suitable basis for the provision of a filtering tool with the advantages of allowing users, particularly novices, to begin to move through the various stages of internalising a cognitive map of the web site.

There are several obvious advantages to the identification of landmarks in web site. Users, when disoriented or who fail to find a target item, tend to return to focal points in the system (Norman, K., 1991; Shneiderman, 1997) The home page of a WWW site is typically the major landmark in the system hence when users get lost they typically reposition to this node resulting in inefficient and unproductive navigation paths (Norman, K., 1991). Performance may be improved by making users aware of the landmark nodes in their current

region of the site enabling them to reposition to these nodes rather than the home page when disorientation occurs.

Identification of landmark pages in web sites may be achieved by examining factors that contribute to the prominence of a page. Landmarks may be identified as pages that:

- are frequently accessed (Norman, K., 1991; Tomek & Maurer, 1992). Access logs in web site may provide a measure of the popularity of each page in the site.
- are transition points where fundamental turns are taken (Norman, K., 1991). Identification of transition points may be achieved by considering the number of links to and from each page.
- have salient qualities that provide memorability. Factors that may be considered include the depth from the home page and the actual file size of the page that may indicate the relative complexity of the design.

There have been few attempts at implementing a site map system that implements filtering based on landmarks. Mukherjea & Hara (1997) utilised the metrics of connectivity, access-patterns and depth to identify landmark nodes then applying the measure as a filter for the generation of static WWW site maps however the approach involved a time consuming pre-processing step to create the display.

The 'SiteTree' Site Map System

SiteTree is an experimental site map system that has been created in order to explore a range of issues relating to the design of site map systems. The system displays a hierarchical abstraction of the site, which provides basic filtering and visualisation controls, including landmark functionality. SiteTree has been implemented as two separate programs: a 'SiteTree Database Generator' and a 'SiteTree Client'.

The SiteTree Database Generator has been implemented as a Java application that maps the structure of a web site by building a database of links. The database is created by utilising a traversal algorithm that follows all paths in the site from a nominated starting point URL. This URL scopes the breadth of the traversal, ensuring that links outside the nominated server are documented but not followed. The algorithm ensures that all reachable pages are included in the database and also handles recursive links to avoid duplicate entries in the database. The site database generation program creates two tables: The 'Link Database' documents the structure of the web site by describing all links between the pages on the server and includes two fields: URL, parentURL. The 'Page Attribute Database' describes the attributes of each of the pages in the web site, including URL, title, size, type, depth, inlinks, outlinks, hits, lastupdate and priority.

The priority field is used to determine the degree of prominence of each page enabling the identification of pages that have the qualities of being a landmark. This value is calculated dynamically by the server program using an algorithm based on number of hits, inlinks and outlinks. This field is used by the SiteTree client to allow the "landmark" filter to be manipulated in order to hide or show landmark nodes. The current algorithm places 30% emphasis on links in, 20% on links out and 50% on hits.

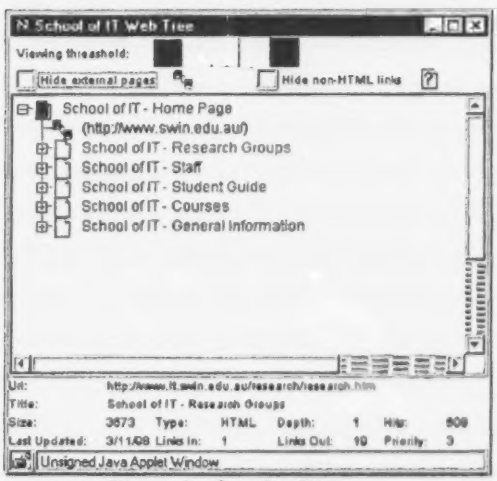
School of IT Web Tree
Viewing threashold:
Hide external pages
Hide non-HTML links
School of IT - Home Page
(http://www.swin.edu.au/)
School of IT - Research Groups
School of IT - Staff
School of IT - Student Guide
School of IT - Courses
School of IT - General Information
Unsigned Java Applet Window

Figure 1 – Opening Map

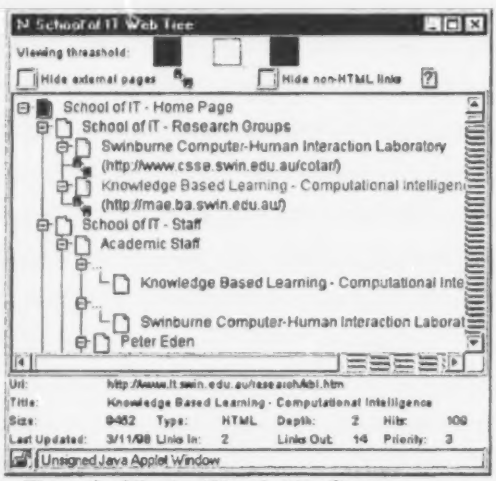

Figure 2 – Viewing Threshold = Green

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The SiteTree Client has been implemented as a Java applet. The basis for the design of the interface not only includes functionality to support the identification of landmarks but also considers several other key issues including the importance of hierarchy and the need for local and global view.

Hierarchical representations are useful in organising information and reducing the number of alternatives that must be considered at any one time (Norman, K, 1991). Parunak (1989) suggests that tools should impose simpler topologies onto complex structures to aid navigation hence by providing a hierarchical abstraction of the structure of the site to assist the user in constructing an appropriate mental model will improve a user's ability to interact with a system. To achieve an appropriate hierarchical representation in the SiteTree interface, the 'level' field in the page attribute table is used to layout the information in the links table. The applet initially displays all nodes in the first level of the site (Figure 1) where each page is represented by an icon and the page title. A user may double click the page title or icon to open the appropriate page in the web browser.

Basic filtering controls are provided to both hide/display external links and links to non-html pages. The hierarchical layout and use of colour coding provide an integrated view of key page attributes. The panel at the bottom of the applet window also displays page attributes of the page that is being pointed to. As the mouse pointer moves over the node symbol or title, the node title changes to red and the attributes are instantly displayed. The attributes include URL, title, size, type, depth, hits, last update, links in, links out and priority.

Implementing Landmarks in SiteTree

Landmarks are implemented in the applet by utilising a colour-coding scheme to indicate differing priority values for nodes. Local htm-type pages are represented by a "page" icon that ranges in colour from blue (low prominence) to red (high prominence). Users may change the "viewing threshold" by clicking on the appropriate colour in the control panel. This control provides the user with the ability to filter out certain nodes in the site map based on the value of the priority attribute leaving more important 'landmark' nodes in the view. This landmark overview is an alternative to other overviews that provide filtering on the basis of depth from the root node. It is hypothesised that an abstraction based on usage (hits) and importance in the structure (in/out links) is optimal compared to a static abstraction based on the perceived importance of each node by the site map designer. Figure 2 shows a site map with the viewing threshold set to the 'Green value'. In this view only pages with a priority of 3 or greater are displayed in the hierarchy.

Conclusion

One of the challenges confronting the designers of web sites is effective navigation. The solution to such problems is linked with the ability to visually represent the contents of the documents in the system and then to present these on a screen in such a way to provide the user with orientation and interactive navigation. This paper has explored the psychology of physical navigation especially the role of landmarks and through the implementation of an experimental 'SiteTree' WWW site map system has proposed the use of landmarks as an effective method of implementing filtering on WWW Site Maps.

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Online Faculty Development: A PT3 Concerns-Based Technology Adoption Model for Teacher EducationUsing Electronic Portfolios for Performance Evaluation

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As more UC faculty and especially teacher education faculty are encouraged to restructure traditional methods, related relevant content courses, and instructional approaches, including technology into courses as a response to changing student populations and the resulting need for alternative modes of learning, it is critical to collaborate with faculty to create professional development that unites technology and pedagogy. This partnership with faculty must come early in defining that model. During Year 1 using the CERTI2 model as a case study, our goal is to capture the process of implementing an integrated technology-pedagogical model through the expertise of 10-15 CERTI2 faculty associates. These associates will allow faculty using technology across the Arts and Sciences, Curriculum and Instruction, and Special Education disciplines to serve as liaisons among faculty and between faculty and instructional designers. In providing support to faculty in CERTI2's move toward this integrated model, we are preparing varying levels of research, technical and professional support, consulting to dialogue about implications for pedagogy, the nature of resistance, and ways to scholarly document and disseminate success encountered in establishing a faculty professional development program to infuse technology within Teachers College. During Years 2 and 3, this information will ultimately embody infusion throughout preservice teachers field-based experiences and online support and portfolio systems. This extensive effort will profoundly change the teacher education program and provide collective benefits to the university, schools, and the Cincinnati urban community and neighboring areas. By the end of Year 3, it is estimated that CERTI will impact over 2,000 teachers and 40-50 university faculty.

Navigation is Law: The Conceptual Architecture for Layered Web-based Information Systems

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Abstract: Navigation capability is considered as the most important facet of a large information space as it is the indicator to identify the ease of locating information in the space. Therefore, the navigation structure of an information space must be well designed and instructed to minimize learning requirements and maximize efficiency of use. This paper proposes a new hypertext system called the Retriever Information System in which it is designed to promote ease of navigation in a wide information space. The Retriever introduces the separation of the navigational context and the actual content of documents. It requires validation of navigational context to ensure the proper integration of documents in the Retriever navigational structure. Currently, the Retriever is planned as a layer on top of the current Web infrastructure to raise the navigation capability of the World Wide Web.

1 Heuristics for Designing Information Navigation

The navigational architecture of an information space is considered in this paper as the most important part of the space that contributes to the ability of users to search for information. This paper proposes heuristics to create a navigational structure such that a navigational structure must be designed to (1) *minimize learning requirements*, and (2) *maximize efficiency of use*.

There are several issues to consider in minimizing learning requirements. Topics that are related to the design of the Retriever are discussed here. The first concern is the *level of navigational consistency across the entire information space*. The Web shows minimal level in this issue. For the Web, it is frequently found that users must examine pictures and texts on a Web page in which they may be links, as links can be customized in each Web site differently. The second issue involves the *complexity of navigational structure*. Intuitively, complex navigational structures are harder to learn than the less complex ones. To overcome this issue, the third requirement for ease of navigation, i.e., the *predictability of navigational behaviors* must be well implemented. The Web contains low ability in this topic. For the Web, it is almost unpredictable about the changes of navigational structure when users click at links. Furthermore, users are frequently required to learn new navigation structures when they navigate from one Web site to another. The Retriever attempts to overcome these issues by separating navigational context from document content.

There are also several issues for maximizing efficiency of use in which the issues that are relevant to the design of the Retriever are discussed here. The first item includes *flexibility for content arrangement* such that requirements for navigation should not prevent content designers to arrange information according to their intentions. However, the requirements must enforce in a certain level to ensure the integration of navigational ability across the information space. The second issue is the *availability of information*. It involves steps users are required to accomplish in order to access a piece of information. URL shows a great example in this issue such that it needs only one step to retrieve information, as it is a complete point to the information. Nevertheless, the availability of information must balance with the third issue, i.e., the *accessibility of information*. This topic deals with sequence to access a piece of information such that, in order to maintain its meaning, information needs to access according to its sequence. The Retriever employs URL to specify locations of documents in conjunction with access flags to indicate the access methods required for documents.

Conclusively, as navigation is considered as the main issue of a large information space, this section discusses heuristics for designing a navigational structure in which they are employed to design the Retriever Information System, which is presented in the following section.

2 Retriever Information System

2.1 Overview

The design of the Retriever is largely influent from the Web and the Gopher Information System. The Gopher is a hierarchical information system that is predated the Web. The Gopher, unlike the Web, restricts its navigational structure. Users navigate within the Gopher's hierarchical path in order to retrieve information, and users are not able to

jump from one node to another in the hierarchy that has no explicit hierarchical link with the previous one. With less capability on enriching user interactions than does the Web, the Gopher is now considered being obsolete.

The Retriever is an attempt to combine the explicit navigational structure, as in the Gopher, with the flexibility of information presentation and the hypertext ability of the Web. Ease of navigation is the main concern on designing the Retriever.

2.2 Structural Concept of Retriever

In the Retriever information space, documents are arranged in the hierarchical fashion. The Retriever aims to promote the well organization of hypertext documents by implementing a number of restrictions. A Retriever document consists of *navigational content* and *information content* parts. In this current stage of development, the navigational content is primarily studied, and the information content at this time is specified only as it contains texts and links to other documents. Additionally, each part is planned to display to users in different areas to prevent the fusion of the user perception of navigation and information contexts. The visualization methods to present both parts to users are currently under extensive studies.

The navigational content of a document consists of several items to aid efficient navigation in the Retriever information space. All items are required in order to produce a valid Retriever document. As the Retriever employs strict rules to prevent navigational difficulties, an invalid Retriever document is not allowed to display.

Navigational content of each document is unique. Thus, it also serves as the full address of the document. As a document is a node of the Retriever hierarchical structure, navigational content of a document contains (1) document handle, (2) document title, (3) access flag, (4) parent node address, (5) previous node address, and (6) list of links in the document. For the previous node address, the null value is used when a document is the beginning of a sequence. However, every document must have its parent node address. For the root document of a site, its parent node address is the root document of the Retriever information space. The document handle of a document is its URL. The access flag of a document can be O (open), R (root-protected), or S (sequence-protected). The open documents can be accessed from any documents in the Retriever space; the root-protected documents must be only entered from their parent documents, and, the sequence-protected documents must be accessed only from their preceding documents. The root-protected and sequence-protected documents are designed to support several application potentials, e.g., category explanations or checkout procedures of e-commerce sites.

The navigational content of a document, which is also used as the address of the document, contains two addresses, namely, its parent node, and its previous node. This requirement results accumulation of addresses in which one address of a document encloses the address of another document that in turn contains the address of another document and so on. Hence, as a document resides deeper in the hierarchy, its navigational content tends to be exponentially larger than the shallower one. As a result, the Retriever as a whole consumes more communication bandwidth than does the Web or the Gopher. Nevertheless, with the advance of telecommunication technology nowadays, the benefit of having complete navigational information embedded in each document, which can be visualized and validated, is expected to overcome the moderately high use of communication bandwidth.

2.3 Navigational Validation

In the Retriever, only valid documents can be displayed. Document validation is achieved by analyzing the navigational content of a document. Currently, the validation consists of the *navigational validation* phrase and the *access validation* phrase. In the first phrase, the document is verified whether it is properly placed in valid location in the Retriever information hierarchy. It is done by recursively analyzing the previous node address and the parent node address in the navigational content of the document in which whether or not they also exist in valid location in the hierarchy. In the second phrase, the access flag is interpreted. If the navigational content of the document contains the "O" (open) access flag, the document can be accessed from any sequence. In case of the "S" flag, the document must be entered from its previous document, and a document with the "R" flag must be accessed from its parent document. After the validation, the valid document or an appropriate error message is displayed to users.

3 Future Directions

The Retriever information system is currently in its early stage of development. Presently, the study is primarily conducted on its conceptual architecture and its presentation of information and navigational contents. In the next stage, the communication protocol of the Retriever will be designed, and the client and server applications of the Retriever will be implemented for demonstration. At this time, they are planned to implement as a layer on top of the existing infrastructure of the Web. The eXtensible Markup Language (XML), which is currently the standardized language for information representation and interchange, is expected to employ in the design and development of the Retriever communication protocol and document presentation.

Measuring Web Navigational Capability Using Paths, Distances, Loops, and Routes – the WebStruct Tool

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Navigational capability is an important issue for the World Wide Web. This poster demonstration proposes an initiative study on analyzing paths, distances, loops and routes of a Web site as a means to measure its navigational capability. An automated tool for analyzing navigational capability of a Web site entitled the WebStruct Tool is also presented.

Technology as Facilitator of Quality Education: A Model

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Abstract: Few people would argue with the idea that information technologies have a major impact on how we view schooling, teaching, and learning at this point in time. If technology is indeed a facilitator of quality education, how will it be used? How can developments in information technology facilitate an education appropriate for the 21st century while enhancing student achievement in core areas deemed important to our democratic society? This chapter describes the Technology as Facilitator of Quality Education (TFQE) model currently being developed at the University of Northern Iowa. Technology as Facilitator of Quality Education: A Model. This model includes seven major dimensions: students at the center of their own learning; principles of good learning; aspects of information processing; standards from content disciplines; tenets of effective citizenship in a democratic society; teacher knowledge and behavior; and technology.

Few people would argue with the idea that information technologies have a major impact on how we view schooling, teaching, and learning. They may, however, argue about the *kind* of impact that we currently feel from the use of technology in our classrooms. Opinions range from those who see technology as the driving force for all that will be good about education in the future, to those who see information technology as a force that will destroy education as we now know it, driving us toward all of the negative aspects of consumerism.

Like most complicated technological developments and their associated social changes, the potential impact of information technology on education is somewhere between these two extreme positions. Decision-making is, of course, still the key to the impact that technology will have on education. One would hope that informed human beings would find a way to capitalize on the best of what information technology has to offer, while preserving the core components of our educational system. This blending of the new with the old is most likely to serve us well in the future and provide us with a foundation for effective citizenship in a democratic society.

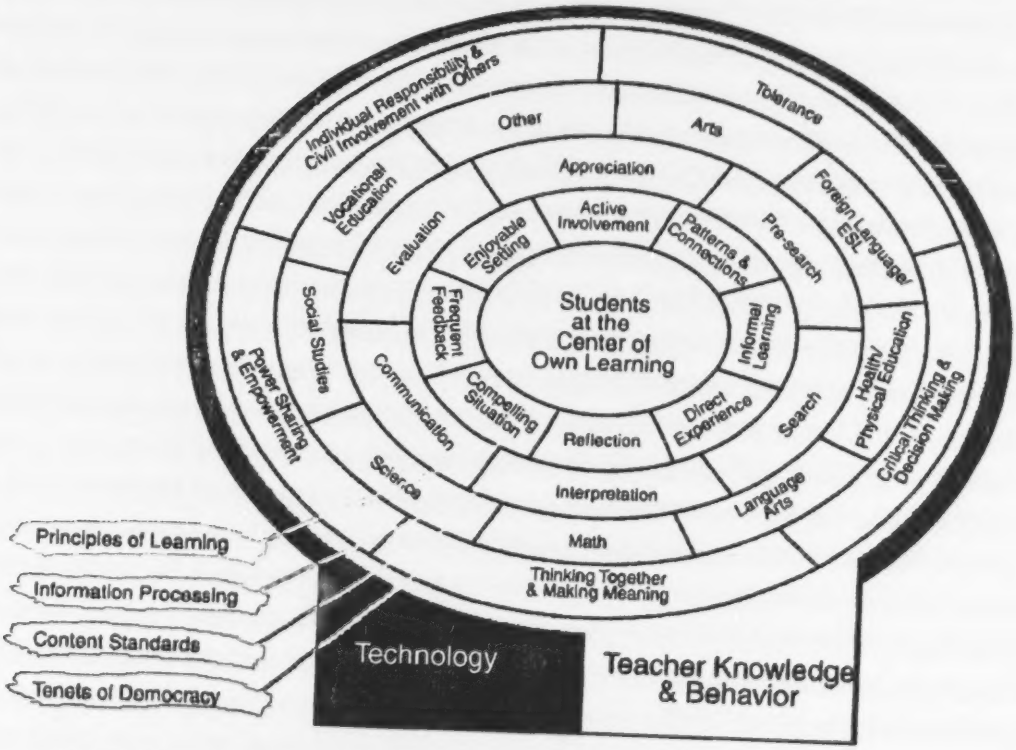
People who fear the consequences of developments in information technology frequently do so not out of ignorance, but from the realization that these technologies present the possibility of a fundamental shift in how we think about the nature of schooling, teaching, and learning. They question the consequences of such a shift. Unfortunately, those who advocate this shift have not developed a persuasive rationale for their position. In their rush to support technology, they have failed to show how the shift can actually promote the core values of education in a democratic society.

If technology is indeed a facilitator of quality education, how will it be used? How can developments in information technology facilitate an education appropriate for the 21st century, while enhancing student achievement in core areas deemed important to our democratic society? Technology as Facilitator of Quality Education (TFQE) is a model (Figure 1) currently being developed at the University of Northern Iowa. It includes seven major dimensions:

1. Students at the center of their own learning
2. Principles of good learning
3. Aspects of information processing
4. Standards from content disciplines
5. Tenets of effective citizenship in a democratic society
6. Teacher knowledge and behavior
7. Technology

The seven dimensions of the model provide a way for educators to view the integration of technology-related tools into a robust educational environment and thus answer the hard questions regarding support for the shift in our educational activities toward technology. The model sets up a framework for this robust educational environment and identifies key points at which technology should be implemented and evaluated to determine its impact. It simultaneously allows for the integration of new research findings, while maintaining the structure to evaluate the impact of technology tools on these new findings as part of an ongoing evaluation process. In so doing, the model allows a variety of stakeholders to see the complex process that is education and how technology is affecting that process.

Figure 1: Technology as Facilitator of Quality Education Model



The TFQE model allows us to view the integration of technology as an essential set of tools being used appropriately in a robust educational environment, a democratic setting in which students are at the center of their own learning. Addressing deficiencies in the use of technology in K-12 education using the TFQE model, a consortium of schools have developed the InTime project (Integrating New Technologies Into the Methods of Education, http://www.intime.uni.edu/), funded by a Catalyst grant from the U.S. Department of Education.

Drawing on the TFQE model, this project is intended to produce change in teacher education programs in three ways. First, new learning resources on the Web will be generated to support new teaching and learning processes in education methods courses. These resources will include development of video scenarios of preK-12 teachers effectively integrating technology, along with components of quality education, in a variety of grade levels and content areas. The videos will be stored on a video server already in place at the University of Northern Iowa and made accessible on-line nation wide.

Second, methods faculty will revise their courses to model technology integration using the video scenarios and on-line discussion forum, require students to apply technology, and implement the Preservice Teacher Technology Competencies as exit criteria for their courses. Finally, methods faculty will share strategies for integrating technology and course revisions with other faculty involved in the grant through a variety of activities. Each participating university will ensure that faculty members have access to adequate

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resources that support the integration of technology into methods courses, providing one-on-one technical support to those faculty members who are revising their courses to integrate technology. Methods faculty members will also participate in faculty development programs to revise their methods courses to incorporate new learning resources and new standards. A professional evaluation team will assess the overall effects of the project on teaching and learning, as new learning resources are developed and implemented, along with new standards, into methods courses.

The Technology as Facilitator of Quality Education model within the context of the InTime project is intended to provide teachers and instructors of teaching methods classes with a rich resource for integrating technology throughout the school curriculum. It is only through full integration and use throughout the curriculum that the full potential of technology will be realized.

A Living System Design Model for Knowledge Management Systems

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Abstract: Most of the currently available instructional design models were conceptualized to develop instructional solutions to needs and requirements that remain relatively stable over time. In order to design a knowledge management system that was able to accommodate continuously changing requirements over its fielded lifetime, we developed a new design model that is based on a living system approach. After reviewing currently available ISD models we describe this new model and the living system approach for accommodating change and growth it is based on. We then describe the steps of the model, analyzing initial requirements, designing the information architecture, developing the information design and interaction design, implementing the web-based system, and conducting a developmental evaluation of the system.

Introduction

The systematic design of instruction has long been recognized as a key to the successful development of effective and appropriate materials (Gagné & Briggs, 1979; Dick & Carey, 1990). As developers of Computer-Based Instruction (CBI) recognized the difficulty in successfully taking a CBI project from conception to delivery, they adapted methods and techniques created in the computer industry for managing software development projects. Many of these early software development methods were adaptations of the Waterfall Approach (Yourdon & Constatine, 1978), a highly structured method for project management that delineates the design process into clearly defined phases – analysis, design, implementation, testing, and delivery. As the CBI field matured, development methods began to incorporate concepts and terminology taken from the Instructional Systems Design (ISD) approach (Gagné & Briggs, 1979). Most popular adaptations used ISD front-end methods to establish the purpose of the application and techniques adopted from software development methods to implement the application (Alessi & Trollip, 1991; Dick & Carey 1990).

In the software-engineering world, flexible methods of project management based upon iterative prototyping – sometimes called evolutionary system development – were becoming increasingly popular for commercial software projects (e.g., Moody, Hudson & Salisbury, 1988; Jones & Richey, 2000). Collectively, they have become known as RAD (Rapid Application Development) methods (Boar, 1984). Due to the success of iterative prototyping methods such as RAD for developing general software applications, combining ISD methods with iterative prototyping became the next breakthrough in development methods for CBI (Koper, 1995). This approach differs from previous ones by explicitly supporting an *interleaved* form of project development on different levels, both to refine the objectives of the system and to provide feedback for the evaluation phase of the iterative prototyping method.

In most instructional design methods, once a need was established and the parameters and requirements for the instructional solution were defined and implemented, no procedures were in place that would allow for their revision and subsequent modification of the system after it had been deployed.

Designing Systems with Changing Needs and Requirements

Combining ISD methods with iterative prototyping has addressed many of the limitations of using a traditional approach for developing CBI applications. However, we found that this hybrid approach, and those that came before it, were not well suited for the challenges that we were facing in a project where we developed an integrated and evolving knowledge management (KM) system. While they were able to address some changes in needs and requirements during the development of the project, these methods were not designed for building systems that have continuously changing requirements over their fielded lifetime due to changing

needs of the organization or institution that is using the system. A design method for the development of a knowledge management system, however, needs to address two additional levels of change.

The first level of change concerns the organization that will use the system. Here, during the fielded lifetime of the knowledge management system, new requirements and needs have to be anticipated that result from changes in the organization. These changes may include new characteristics of the target audience for the system due to new hires, the amount, content, type and structure of the information included in the system, and, as a consequence, the forms and methods of learning and instruction used in the system. A second level of change concerns the KM system itself. Most instructional materials are not designed to be modified by the learners and their interaction with the system. In the case of a knowledge management system, however, this functionality constitutes one of the fundamental system requirements. Acting as learners, users retrieve information from the system to solve a particular problem. Once they have solved this problem, however, they act as authors and add their newly constructed solution to the system. The resulting growth of the knowledge management system will depend on the needs of the organizations and will change over time. Therefore, mechanisms have to be designed and implemented that can accommodate these changes.

These two types of change closely resemble characteristics we can observe in living systems (Maturana & Varela, 1980). Using this analogy, a knowledge management system needs to be able to adapt to its environment, i.e., the changing organizational needs. It also needs to be able to grow and learn, i.e., to respond to the individual needs of learners.

More recent development methods and models, such as object-oriented design approaches (e.g., Coad and Yourdon, 1991), User-Design approaches (e.g., Banathy, 1991; Reigeluth, 1993; Schuler and Namioka, 1993), and even the more recently proposed constructivist models of instructional design (Willis, 1995; Tennyson, 1997) also do not explicitly address this problem of building systems with evolving requirements. Therefore, given the limitations of these methods for building systems with continuously changing requirements, a new design model is needed that explicitly supports the development of systems for organizations with changing needs and requirements. In this article, we describe this design model and the living system approach it is based on.

Living System Approach

In order to develop a design method that allows for the development of KM systems that can accommodate changes even after they have been deployed we approach the system as a living and adapting organism. That is, since growing and sharing knowledge is, by definition, an ongoing and self-modifying process, the goal is to design and build a system that is adaptable to its environment – a living system. This view of a system as a living entity falls under research that has been labeled *autopoiesis theory*. This concept was developed more than thirty years ago by biologists Maturana and Varela (1980) to define the distinction between living and non-living systems. Autopoiesis is Greek for "self production," and an autopoietic system is one that has within its own boundaries the mechanisms and processes that enable it to produce and reproduce itself. The system constructs its own knowledge through the process of accommodating data from the environment, shaping and changing the very structure and nature of the system in the process (von Krogh, Roos & Slocum, 1996).

Requirements for a KM system can change for a number of reasons. Retirements and new hiring will result in changes in the target audience. At the same time, the information made available through the system may be in a process of continuous updates and revisions. In addition, a knowledge management system is designed to grow by capturing knowledge from members of the organization.

As a practical mechanism for the design of knowledge management systems that can incorporate such change on different levels, we developed and applied the following phases (see Fig. 1):

Analyze End-User Requirements

Viewing the development process as an ongoing and continuous effort to design a system that is adaptable to its environment, the first step is the analysis of the initial end users' needs and requirements and the identification of the target audience as well as goals and objectives for the system. This phase follows mostly the procedures specified in other, more traditional ISD models described earlier. Outcomes of this phase are the decision if a knowledge management system can indeed meet the organization's needs and, if this is the case, the initial end-user requirements of the goals and objectives regarding the function and performance of the system, the target audience who will use the system and their characteristics, and a description of the minimum

configuration of the delivery platform for the system, i.e., the resources and constraints of the available computer hard- and software as well as network connectivity for the delivery of the materials. Note that the goals and objectives do not necessarily determine specific learning outcomes, as they usually do in traditional ISD models. They instead describe the system features and functionality that will allow learners to construct knowledge according to their needs.

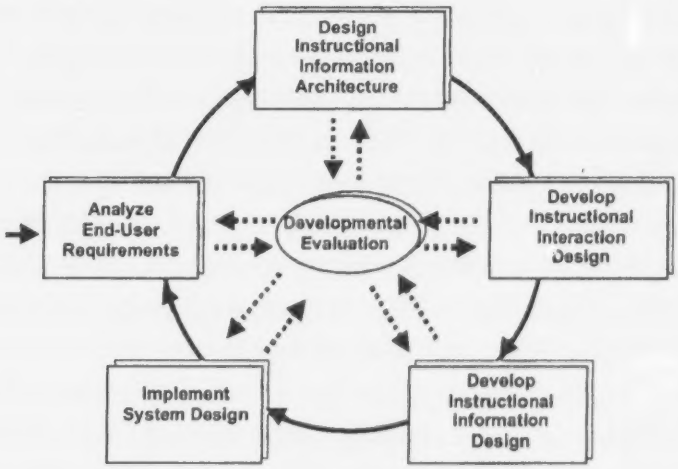

Figure 1. Living System Approach to the Development of Knowledge Management Systems

Another issue in which this phase differs from other models is in the use of the outcome of the analysis. In many models, the results of the needs analysis are used as input for several other phases on the design process but are not reassessed or updated after they are initially obtained. In our approach of treating the system we develop as constantly changing, we recognize that key outcomes of this analysis have to be frequently reviewed and updated in order to be valid input for the next phases, following the idea of a needs reassessment outlined by Tessmer, McCann and Ludvigsen (1999).

Design Instructional Information Architecture

Based on the results of the analysis of the end-user requirements, this phase is concerned with the design of the instructional information architecture. The purpose of designing an information architecture is to map objectives onto the functionality of the system and define its structure, to map the content of the system on the functionality, and to design the general navigational system (Rosenfeld & Morville, 1998). We use the term *Instructional Information Architecture* for a conceptual design that emphasizes the instructional function of the system and that focuses on the facilitation of the users' learning processes. This implies that the design of the functionality and structure of the system is informed by appropriate learning theories and frameworks (Plass, Salisbury, & March, 2000).

Based on the learner characteristics, end-user requirements, goals and objectives determined in the previous phase, the purpose of this phase is to specify the functionality that will realize the objectives of the system. This mapping of the system functionality onto the objectives is performed in the context of the structure of the system, which can be based on certain relevant domain-specific tasks, the structure of the content, the structure of the organization, or any other appropriate form of organizing information (Rosenfeld & Morville, 1998). The output of this phase is an information architecture flow chart that shows the major components of the system, how they are connected, what the initial specifications for their functionality are, and how the navigation of the system is organized.

One way in which this phase differs from other ISD approaches is that the functionality of the system also includes features that allow for the accommodation of change and growth. These features include administrative tools, knowledge management capabilities and living system capabilities. Administrative tools allow for the update and modification of user information and of certain periodically changing content that would otherwise require changes to the system implementation, as well as project management tools.

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Knowledge management capabilities allow users not only to retrieve information from the system, but also to store relevant information in the system, making it available to others. Living systems capabilities can be described as the digital nervous system of the site that provides real-time information such as overall system status, usage statistics for features, demand on resources, and system growth that allow for adjustments to the system to accommodate the changing requirements.

Develop Instructional Interaction Design

The interaction design of the system capabilities and features specifies the user interaction with the (visual) interface of the feature, i.e., the communication between the user and the system functionality. This includes the input required and how it is given, as well as the output and its format.

As in the previous phase, we use the term *Instructional Interaction Design* to put special emphasis on the user's learning processes and on the cognitive processes involved in the learning task. This goal of instructional interaction design is the design of instructional strategies that are appropriate for the target audience and the instructional content and that take advantage of the unique characteristics of the delivery medium. This can be achieved, for example, by applying principles derived from Cognitive Load Theory (Sweller, 1994), as well as from media attribute theory (Salomon, 1979).

The steps to be performed in this phase include a task analysis, a cognitive task analysis, the design of the human-computer interaction for each feature and the selection of interface elements that support them, and some general screen layout decisions. The output of the interaction design phase consists of detailed specifications of the way the interaction of the user with the system is performed.

Develop Instructional Information Design

The information design specifies the representation of information in the various forms, symbol systems and media types. Where the interaction design defines the format and style of the interaction between the user and the system, the information design specifies the appearance of these interface elements. That includes for example the color palette used for the visual interface, color coding, background images, typefaces and their form (attributes) used for on-screen text, and the appearance of system controls such as buttons, scroll bars, and navigational elements. Information design employs methods that support *wayfinding*, i.e., strategies and design elements that assist the user in navigating the system and in orienting him- or herself within it and with relation to the desired location or function (Passini, 1999).

Appearance goes beyond the "look and feel" of the visual interface, however. Based on the input from all three previous phases, the information design also includes design decisions that will have an impact on the users' learning processes. Such decisions concern the representation mode for a particular piece of information and the combination of different presentation modes. We refer to information design that takes into account such considerations of the cognitive impact of the choice of the information representation as *Instructional Information Design* (Plass, 1998).

The information design phase is conducted based on the needs, requirements and learner characteristics identified in the analysis phase, the specifications of the features and structure of the system defined in the information architecture, and the specification of their functioning described in the interaction phase, and informed by the cognitive science principles of learning from text and pictures, from maps and from multimedia. The output of this phase is the specification of the appearances of these features.

Implement System Design

Based on the input from the previous phases, in the implementation phase a prototype of the knowledge management system is implemented. Often referred to as the production phase, this phase includes the graphics design, design of other media elements such as sound and video, programming, and the design and implementation of the database backend, a set of tables in a DBMS. This backend enables the technical implementation of all of the features and capabilities that allow the system to grow and accommodate change. Data capturing the number of new records in specific tables allow the system administrator to gauge the rate of growth for each feature. These instruments to measure growth, combined with tools that analyze the user log files, constitute the digital nervous system of the KM system.

The output of this phase is a functioning prototype of the knowledge management system. As such, it includes all of the features specified in the information architecture. The reason why the system is classified as a prototype, however, is the remaining need for user testing and evaluation and the lack of extensive knowledge represented in most of the features. The evaluation of the prototype will be the content of the next phase; the inclusion of knowledge into the system will occur during its fielded lifetime.

Conduct Developmental Evaluation

The purpose of the evaluation phase is to improve the features and functionality of the product. This can be achieved by monitoring and assessing how well these features serve the needs and requirements of the users, and by determining how the system needs to be modified to make features more effective and to accommodate changes in the requirements. The nature of the evaluation is both formative and developmental. The ongoing process of monitoring the status of meeting, over-serving or under-serving the users' needs gives the evaluation a developmental character since it is seen as an essential part of the design process without which a successful product could not be achieved and maintained. Developmental evaluation is used here to describe the long-term partnering relationships with the organization for the purpose of collaboratively developing and maintaining the system (Patton, 1994).

The compliance with the users' needs can be assessed on two levels, learning outcome and usability. The evaluation of the learning outcome can be conducted on any of Kirkpatrick's (1994) four levels of evaluation. Usability testing, sometimes also described as acceptance testing, refers to the ease of use of the system and of learning, and includes criteria such as the time needed to learn specific functions of the system, the speed of task performance, the error rate in such performance, and subjective user satisfaction (Shneiderman, 1992). Applied to our model, usability evaluation means the evaluation of the design decisions made in the information architecture, interaction design, and information design.

In order to be able to identify changing needs of the organization in a timely manner, a formative evaluation of each phase is necessary before the next phase can be approached, which is visualized using dotted lines in Figure 1. This evaluation should always include a reassessment of the requirements of the users and the organization. If combined with surveys and interviews, this method allows for a timely accommodation of changes in the target audience or in the needs of certain groups of users. This approach of using a developmental evaluation to compare the features and functionality of the implemented system with the current end-user requirements by closing the circle from *Implement System Design* to *Analyze End-User Requirements* (Figure 1) results in an inherent capability of the model to accommodate change and growth. If the requirements of the end-users have changed, modifications to the system can be made automatically (e.g., scheduled automatic updates), semi-automatically (e.g., update of information based on administrative tools) or manually (e.g., the development of new features based on new needs and requirements).

Discussion and Conclusions

While all of the existing methods for the development of CBI described earlier have been successfully used to develop applications, they were not conceptualized for building systems with continuously changing requirements, such as changes in the characteristics of the target audience, in the amount, content, type and structure of the information, and in the forms and methods of learning and instruction used in the system. We therefore developed a new design model, described in this article, which is based on a living system approach that is designed to provide explicit mechanisms to design features for knowledge management systems that can accommodate growth and change. The design model has been successfully used to implement a knowledge management system for a large government organization (Salisbury & Plass, in press) and is described in more detail in Plass & Salisbury (in press).

The ability to grow and change and, therefore, to adapt to the changing requirements of its users, is the most important characteristic of the systems for which this approach was developed. In our opinion, this capability has fundamental consequences for the design and development of systems that take advantage of it. While most other systems may reach a point where they are considered to be a finished product, these systems are by design never completed. The consequence of such a constant state of change is that the development process is never completed either. The evaluation of such a system is therefore always of a formative nature, and since it involves the ongoing collaboration with the organization that owns the system it can also be considered a developmental evaluation (Patton, 1994). A comparison of this cycle of feedback and accommodation in the KM system we designed and those in an autopoietic system shows that both have within their own boundaries the mechanisms and processes that enable them to produce and reproduce themselves, which is characteristic to living systems.

The design process we employed is cyclic in nature, reflecting the philosophy of accepting change as a factor in the definition of the KM system. While the execution of the first cycle of the design involves the initial analysis and assessment of need, design of the information architecture, interaction design, information

design, and system implementation, the next design cycle can take advantage of the living systems features implemented in the system. In other words, much of the information that had to be collected in the needs assessment using interviews, document reviews, and observation of performers can now be captured using the digital nervous system of the KM system, which collects information on the use of the system and its features and gauges its growth. The information obtained from the digital nervous system, combined with other sources of information (surveys, field visits and email feedback from users) results in a multi-level approach to formative evaluation in which data collection and evaluation are ongoing.

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Rural Telecenters: Problematic Issues and the Need for New Educational and Developmental Approaches

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Abstract:

This paper analyzes some of the basic assumptions of telecenters, according to the implementation of this strategy in different countries. It also discusses the relationship between telecenters and development in rural areas. After this panoramic view, a case study in the province of Puebla, Mexico is presented. The exploratory study was conducted by a group of researchers in three of the seven existing telecenters supported by the Provincial government with the aim to obtain information about the interaction processes of community memebers, staff, technology, and information. Conclusions of this research are presented, as well as a proposal towad a people centered approach to be pilot tested during 2 years. The aim of this pilot project is to generate generalizable results that may lead the implementation of the telecenter approach in the Province, and possibly the generation of nationwide policies.

The Basic Assumption of Telecenters

The establishment of telecenters, telecottages, as well as information access centers, has spread widely during the past two decades. A review of the rationale used by diverse countries (both developed and underdeveloped) as the basis for the establishment of telecenters in rural areas, demonstrates the fact that information access technologies may help in overcoming economic problems in such areas.

Telecenters were born in 1985 in Scandinavian countries as an alternative to overcome the developmental problems created by centralized economy (Qvortrup, 1998). Since then, telecenters have spread rapidly, first to the rest of Europe, continuing to Australia and Canada, followed by Brazil, rural areas in the United States of America, and third world countries of Latin America, Asia, and Africa.

Qvortrup, (1998), argues that telecenters are a means for overcoming the four main information access barriers that are characteristic of rural and low-income urban areas: (i) the network barrier, exemplified by the absence of telephonic systems. (ii) The service barrier, which concerns the lack of basic services and the implementation of services that meet urban needs but not necessarily rural demands. (iii) The cost barrier, meaning the cost of hardware, software, technical support, internet service providers, and technological upgrading. (iv) The qualification barrier, regarding the skills needed for computer and telecommunication services which people in rural areas usually lack.

Telecenters and Development in Rural Areas

This rationale seems to be increasingly present in the proposals advanced by decision-makers in charge of developmental policies for the third world. Thus, the heads of various UN agencies, as well as many heads of state, maintain that the poor must have access to the Internet in order to advance socially and economically. A central question in the present research, consists in finding out what would be the specific contribution of new information technologies (NIT's) to promote the development of poor areas, in accordance with the aspirations of the population. For this reason, we think that the principal challenges concern the establishment of innovative rural telecenters, coupled with a continuous evaluation of their performance. In fact, the implementation of telecenters does have drawbacks and obstacles. Some of the problems identified by Delgadillo and Borja (1999), regarding the actual operation of telecenters in Latin America, include: a) internet does not always support the communities' agenda for development, b) there is no communication among the diverse projects, leading to multiplication of efforts, c) there

is insufficient evaluation of the impact of telecenters on community development, d) maintenance remains a problem, the fact that structural questions are often overlooked (e.g., extreme poverty in some communities), e) Casadiego (2000), also stresses that the role of education in the implementation of information and communication technologies has been overlooked. We agree with this, upholding the necessity of an educational basis for all telecenter activities, which takes advantage of the synergy that may be created by linking development programs that are authentically generated by the community itself.

Telecenters in Mexico: a Case Study

Compared with other Latin American countries, in Mexico the history regarding telecenters is rather limited. In 1997 a pilot project was implemented by researchers from the Department of Anthropology of Metropolitan University (Iztapalapa Campus) and funded by the Ministry of Environment and Natural Resources (Valenzuela & Robinson, 2001). Another project is RIO (Red Indigena de Oaxaca); its purpose is to establish communication among similar groups and strengthen cultural identity.

Our case study is based on a project that is unique in Mexico, not only because it is funded by a state government, but also because of its widespread coverage. The initial aim of this project was to offer rural areas access to new communication technologies for educational and developmental purposes. These telecenters are coordinated by the Information and Communication System of the State of Puebla (SICOM). Our main interest was the study of process of interacting with staff, technologies, and information. Results concerning operation led us to the following conclusions. (i) Telecenters focus on introducing new technology without educational support or social promotion. (ii) Beneficiaries are mainly those who have a fairly good level of education and a higher economical status. (iii) Technology is used without a clear or relevant purpose, and therefore does not further actual learning. (iv) Services offered to the community, as well as their evaluation, are based on the efficiency of available resources and the achievement of products that are quantified by means of monthly user statistics. (v) The tasks and characteristics of the telecenters' employees are limited to technological proficiency or skill in the use of hardware. (vi) There is a lack of a clear educational component, both at the management and at the infrastructure maintenance levels.

Summing up, SICOM's way of influencing social and economic development is limited to the offer of free computer equipment and technology.

Towards a People Centered Approach in Rural Telecenters

In order to overcome the problems that we have outlined above, we are proposing a new model for the operation of the Puebla telecenters . This model is well grounded on education and communication theories, as well as on community development approaches. The innovative aspects of this new model include: (i) comprehensiveness, involving diverse applications of new technologies for various rural development needs, not merely focusing on a single one. (ii) Grass-root based, because it is integrated into pre-existing organization and group dynamics in order to catalyze their efforts. (iii) Plurality, because it fosters interaction among three types of actors: civil society, private enterprise and government. (iv) Relevance, because it originates in the peoples' need for information, thus improving the quality of their life, and not in the availability of new technology. (v) Pertinence, since it takes into account the social and cultural disparities within communities. (vi) Emphasis on the development of intelligent and creative group efforts, rather than the development of the skills needed to use the technological tools.

In order to test the implementation of this system, we will undertake a two-year pilot project in one of the telecenters managed by SICOM. We expect that our results will be used by agencies of the Mexican government in order to develop a national policy and to standardize the methodology within all the telecenters of the System.

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Online Multimedia Presentation of a Professional Development Course in Publications Picture Editing

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This course will provide an opportunity for mid-career, professional journalists to enhance their skills in the area of picture management. In practice many picture editors move into their positions without advanced training of any kind. There is a high degree of frustration among the ranks of these editors who feel they may have reached their Peter Principal "level of incompetence." Students successfully completing the course will be awarded a non-degree certificate (Certificate in Editorial Picture Management) and/or may register for graduate credit through an independent study option. The course will be offered online through the Ball State University School of Continuing Education and Public Service. The author is unaware of any other course like this in the country.

HOW ACCESSIBLE ARE WEB PAGES? A COMPARISON BETWEEN BOBBY AND HTML VALIDATOR

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Abstract

This article makes a comparison between two applications whose aim is to determine the degree of accessibility of Web pages: Bobby and HTML Validator. At the same time, this document wants to emphasise the low accessibility of current Web pages. The purpose of this comparison is to identify the advantages and disadvantages of each one of them, for the later creation of a similar tool in Spanish. These two applications are Web pages analysers that follow the recommendations made by W3C (World Wide Web Consortium) reflected in norms WAI (Web Accessibility Initiative).

1 Introduction

The Internet is becoming more and more a commodity item in our lives. However, this statement is not true for every human being. Different reasons limit this generalisation. First, a country status, its economy together with its development can limit the expansion of the Internet. Secondly, one of the weak points of the Internet, leaving aside its speed, is its accessibility: not all of us are able to correctly interpret the content of the Web pages. There are people with certain visual, physical-motor and cognitive handicaps whose access to these pages is restricted when Web pages do not fulfill particular accessibility norms.

In this article we will be dealing specifically with this second group, by focusing on the parameter of accessibility for people who are partially or completely blind, or have temporary difficulties in reading a computer document directly or indirectly by means of speech synthesisers, screen readers, refreshable Braille displays. In particular, we will report a study of two applications designed to obtain more accessible Web pages: Bobby and HTML Validator. We have chosen these two applications because of their user-friendliness and also because Web pages that are qualified as accessible have been certified as so by these two applications. However, there are other applications which have also been designed to solve accessibility problems, but their functions to help designers are more limited. For further information connect to the following Web page:

The two applications considered in this article are based on the norms WAI created by the W3C [1]. These norms are a set of rules established to help Web page designers create more accessible pages. Norms WAI have been designed to be stable, that is to say, they are intended not to be modified in the near future. Without entering in detail, these norms are [2-3]:

- Images and animations: Use the ALT attribute to describe the function of each visual component.
- Maps of image: Use maps of clients and alternative text for the active zones.
- Multimedia: Provide captioning and transcripts of audio, and descriptions of video and accessible versions in the case of using non-accessible formats.
- Hypertext links: Use text that makes sense when read out of context. For example, avoid "click here".
- Page organisation: Use headings (H1, H2, H3...), lists, and consistent structure. Use Cascading Style Sheets (CSS) for layout and style where possible.
- Graphs and characters: Summarise or use the LONGDESC attribute.
- Scripts, applet and plug-ins: Provide alternative content in case active features are inaccessible or unsupported.

- Frame: Use NOFRAME and meaningful titles.
- Tables: Make line by line reading sensible. Include a summary.
- Check the work: Validate code HTML. Use check tools and only -text navigators to verify the accessibility.

In their last version these norms have been divided into three priority levels.

In order to detail the comparison between these two Web pages analysers, this article has been structured in several sections. Sections II and III briefly explain each of the considered applications. Section IV presents their comparison. We have considered first how easy it is to interpret the Web page accessibility errors and second how this information is displayed. These two factors are essential to help Web masters. The last section summarises and concludes this report.

2 Bobby

Booby is a tool intended for Web pages designers. This application tries to help the designer to identify the necessary changes on Web pages so that they are accessible to handicapped users. Bobby was created by CAST (Centre Applied Technology), http://www.cast.org/Bobby/ . CAST is a non-profit organisation whose aim is to increase handicapped people 's opportunities in the technological field. At the moment, it is working together with W3C to develop an evaluation tool, which employs their Web Content Accessibility Guidelines and provides developers with page and site evaluation supports.

3 HTML Validator

It checks HTML documents for conformance to W3C HTML and XHTML recommendations and other HTML standards.
The W3C develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential as a forum for information, commerce, communication, and collective understanding, http://validator.w3.org/ [5].

4 Study

Next, we will indicate the characteristics of each application, to go on with the comparison in itself:

4.1 Bobby tool:

The access Web page to the application Bobby 2,3 consists of two functions. The first function evaluates directly the page that the user requires and the second is informative, allowing the user to download the program to be able to later validate created Web pages on its own computer. Once the user has indicated the Web page to validate its accessibility, the application assesses this page and generates a new Web page with the results of the verification. These results are structured in three parts:

First part: It displays the analysed Web page and it indicates by means of ? (user check points) and the symbol (accessibility errors) which points display accessibility problems. For example, in the following figure (fig 1) the Universitat Autònoma of Barcelona Web site has been analysed. It can be seen that it has some accessibility problems (with this comment we do not mean to question analysed pages effectiveness)

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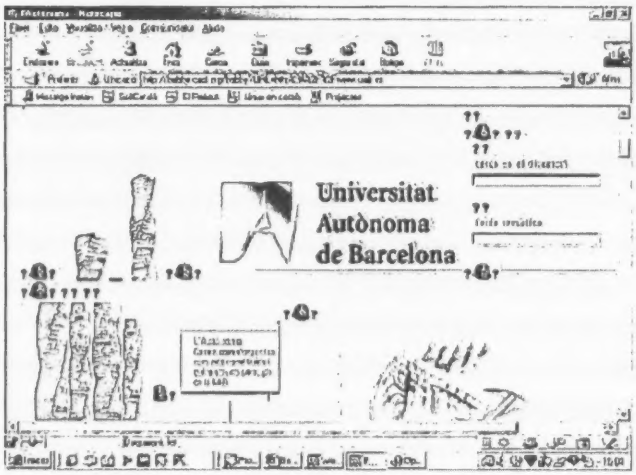

Fig 1: Visual result of the assessed Web page by means of Bobby tool

Second part: It presents the errors of accessibility that has been detected. These errors are indicated according to three levels of priority. Within each priority level any HTML code line that does not fulfil the recommendations is specified and at the same time, a solution is suggested (see fig 2).

1 Priority 1 Accessibility

This page does not meet the requirements for Bobby Approved status. Below is a list of 1 Priority 1 accessibility errors found:

1.Provide alternative text for all images. (15 instances)
Line 24, Line 30, Line 31, Line 35, Line 83, Line 92, Line 95, Line 99, Line 128, Line 131

Fig 2: Result obtained by means of Bobby tool

Third part: It contains a list of browser compatibility errors and the download time. Browser compatibility errors help to determine when HTML tags and their attributes are not compatible with certain web browser or HTML specifications. Browser compatibility errors do not affect the accessibility rating of a page. The download time table gives download time statistics for the images, applets, and objects on this page, using a 28,800-baud modem. See the results in the following fig 3:

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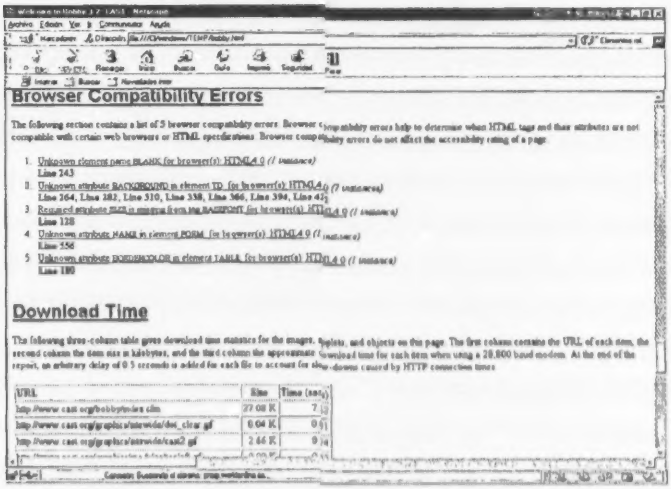

Fig 3: Bobby tool: browser compatibility errors and download time table.

4.2 HTML Validator:

W3C HTML Validation Service allows the user to input the Web page address to be analysed or to load a file by indicating its path. Also, the user can select outline, source listing or parse tree. As output, the application generates a new Web page with information of the Web site: last modification, type of server, type of document. Next, the application displays a listing indicating the line and the column, as well as the code where the error is. In addition, it offers information about how to solve the error (fig 4).

Line 1, column 1:
<html>
^
Error: Missing DOCTYPE declaration at start of document
(explanation...)
Line 5, column 29:

Fig 4: Result obtained by means of HTML Validator tool

4.3 Comparison

When making the comparison, we noticed that each application has its own way to focus on the question about the potentially troublesome information and how to help the designer of accessible Web pages.

Bobby first provides visual information about any weak points on the Web page and then specifies the different priority levels by indicating the errors as well as the tags that should be reviewed. It is a very complete application; nevertheless the great amount of information provided may overwhelmed the designer, since it is not possible to select how the information is displayed.

HTML Validator, on the other hand, does provide an option for selecting the information layout. However, it does not show the errors visually on the same Web page as Bobby does.

We think that such an application should allow the designer first to see the most important errors from an overall point of view and then enable him to increase gradually the accessibility of the page. Furthermore, it should provide us with the possibility of its execution on the server, or of unloading the application for later verifications with no need of being connected to the Internet, as the Bobby tool does.

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5 Conclusion

The main objective of this article is the study of two applications (Bobby and HTML Validator) which are intended for Web masters so that they can improve Web pages accessibility and increase the diffusion of the existence of this type of utilities. The analysed and assessed characteristics of these applications will enable us to design a similar tool in Spanish, which will include the positive parts of each one of the applications we have studied in this article.

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University and County Partnerships: Professional Development Courses in Technology for Practicing Educators and Administrators

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Abstract: Educational Technology Outreach at the University of Maryland offers professional development (PD) opportunities to practicing educators. While expanding into additional Maryland counties and private and charter schools, we have seen a variety of problems arise due to differences in demographics and school system size and resources. Research in PD shows that implementation is critical, as some techniques such as the short workshop model do not remain with teachers and therefore the instruction does not get passed on to the students. This paper will discuss "Best Practices" and lessons learned through ETO's Professional Development model to meet the needs of this diverse group of educators. However, the needs of PD do not end at training. This paper will further describe how ETO has integrated evaluation into its courses via Kirkpatrick's Training Model targeting the third level: has the training resulted in long term integration of technology in the K-12 classroom?

Introduction

The Institute for Technology and Teaching within Educational Technology Outreach (ETO) in the College of Education at the University of Maryland offers professional development (PD) opportunities to numerous counties within the state. While expanding into additional Maryland counties and private and charter schools, ETO has seen a variety of problems arise due to differences in demographics and school system size and resources. Research in PD (Wilson & Berne 2000) shows that implementation is critical, as some techniques such as the short workshop model do not stick with teachers and therefore the instruction does not get passed on to the students. However, many teachers cannot afford the time commitment nor the cost of standard graduate courses. Furthermore, teachers express the need for professional knowledge that directly relates to their everyday classroom activities. ETO has modified its program to meet the needs of this diverse group of educators. This paper will first describe the motivation for the ETO-county PD partnership followed by an examination of the training model used, a progression from face-to-face to online instruction. The paper will conclude with a description of Kirkpatrick's Training model and how it has been integrated into ETO's program.

Research and Program Design

In its 2000 publication, *Computer-Based Technology and Learning*, NCREL stated that technology offers opportunities for student directed learning, increased motivation, connections to the real world, and data-driven assessments tied to content standards that, when implemented systematically, enhance student achievement as measured in a variety of ways, including but not limited to achievement tests. However, in the current environment of changing curriculums, cultural initiatives, standardized testing, yet inadequate technology funding, individual counties and schools do not have the resources and personnel to track research and standards while simultaneously meeting the demands of their schools. However, a county (or school) linkage with a university provides a unique opportunity for needs to be coupled with research, courses to be joined with evaluation, and hands on knowledge to be mingled with accepted best practices.

ETO has undertaken several initiatives designed to meet the specific needs of each individual educational community. While stand alone courses are still offered, the best long term results have resulted from a cohort model,

where groups of teachers move through a string of six modules that extend throughout the school year. This matches earlier research (see Rodriguez & Knuth 2000) which concluded that technology training should be infused over a long time frame rather than in a single session. This research also notes that ongoing discussion and reflection are essential to changing teachers' behaviors in the classroom. Thus, ETO's PD activities occur over an extended time period, thereby providing teachers the opportunity to apply the material within their own classrooms. Additionally, educators have the opportunity to reflect on their attempts with other teachers and together they come up with their own set of best practices.

ETO's cohort begins its training with face-to-face delivery. Instructors are able to assess the skills of the educators in the cohort, and tailor the course to convey the basic technology skills needed in the classroom while also familiarizing participants with the use of the Internet and other tools necessary to move the instruction on-line. Many of the courses are taught off-campus so as to incorporate individual district (or school) standards and software. In this manner, instruction is personalized and allows the teachers' initial technology experiences to be at a familiar and comfortable location. As learning progresses, on-line components such as Internet searches, on-line discussions, chat rooms, whiteboards and other essential distance learning software are added. The final modules move completely on-line, and are taught through WebCT or Blackboard, depending on the particular district. Research shows (see Roblyer & Edwards 2000) that moving to quickly to a totally online environment often fails. By progressing from face-to-face to online, the teachers become comfortable with the online environment and more easily adapt to this new instructional method.

ETO's cohort model does not target solely the teaching of technology skills. It immerses the teachers in a technology based learning environment where they are shown how technology can be used as part of a teaching paradigm rather than being taught technology without any classroom context. This can be compared to the proverb, "Give a man a fish and he has a meal; teach a man to fish and he will never be hungry again." Thus, the instructional model is not merely teaching the skills of operating software; the teachers are experiencing a learning environment that is created by technology.

PD via distance learning is particularly useful to the smaller rural counties who may not have enough teachers to fill a course they wish to offer, yet are located far from the UMCP campus. As a result, via on-line courses and distance learning labs, classes have been filled with teachers from various locations throughout Maryland. This also allows cross-pollination of ideas. Li and Achilles (1999-2000) identified four support systems focused on teachers' learning: (a) technical support, (b) administrative policies showing the need for commitment to technology use by the teaching staff, (c) knowledge of on-going training opportunities, and (d) a forum to share information about teacher successes using technology. Individual counties may be able to provide (a) and (b), but do not have the resources or linkages to fulfill (c) and (d). ETO serves as a liaison between counties to fill this gap. Courses are developed in collaboration with each county; if a need is identified, ETO works with the individual technology organization to design a new course. Other counties then have the opportunity to take this new course as is, or personalize it for their own needs. Thus, all counties collaborating with ETO benefit from the knowledge and experience of their peers throughout the state. Additionally, partnerships develop between counties as both teachers and technology professionals have "met" and exchanged information resulting from their professional development activities. These electronic learning communities provide teachers, technology coordinators, and principals, not only a method for change but a reason for change.

Evaluation

A new and strong initiative at ETO results from a question, often omitted from PD activities: has the PD courses actually changed teachers' behaviors in the classroom? ETO has implemented an evaluation strategy based on Kirkpatrick's Training model. Too often training has been offered to fill a need, without any measures of success. "We need technology so let's teach our educators technology!" But are the courses actually presenting material that is helpful to the teachers, in a context that enables them to apply the lessons to the classroom? How much transfer of knowledge, skills, and attitudes occurs in the classroom after the PD training opportunities? Are teachers passing on what they have learned to the students? Is the knowledge gained still being used in a month, or a year? This is what the third level of Kirkpatrick's model describes and what the training model is trying to measure. Evaluation feedback is used to modify, and expand offerings, as well as lead to new courses.

Kirkpatrick's model has three major levels of evaluation. The first is the "smile sheet", where the student is asked whether they liked the course and the instructor, and the strengths and weaknesses of the course. The second level consists of a pre and post test which seeks to identify how well the material is learned. The third level is most often omitted in professional development and is ETO's focus - has the material been applied? Evaluation

begins with a preliminary skills assessment setting a baseline for the participants. As the courses progress, surveys are distributed which are targeted to how the information is being used in the classroom. After each course concludes, follow-up surveys are conducted, and individuals are randomly selected for personal interviews to see if and how they have continued to apply the skills at three, six, and twelve months after course conclusion. This kind of intensive evaluation could not be done by the university alone; it requires the partnership of the counties who not only have closer ties to the teachers, but also have the directive to evaluate how well ETO's program is working and to show if the technology training is helping to meet district educational goals.

The lessons learned are applicable to all professional development activities. ETO's model provides varied approaches that demonstrate multiple routes to success, tailored to the needs of each institution. The two most important lessons to be gathered from this paper are (1) design educational activities which are flexible, and (2) incorporate evaluation and improvement as an integral part of your program.

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THE EFFECTIVENESS OF WEB-BASED MATERIALS ON INTERNATIONAL STUDENT ADJUSTMENT TO THE UNITED STATES UNIVERSITY ENVIRONMENT

Kerry Purmensky

Goal of the Study: The goal of this study is to determine the effectiveness of web-based, pre-arrival materials on the adjustment of International Students to the Southern Illinois University (SIU) campus. The four specific research questions are:

As measured by survey, do international students at Southern Illinois University Carbondale (SIUC):

1. have access to the Internet?
2. utilize the website for information regarding university life?
3. consider website material influential when making decisions about which university to attend?
4. As measured by survey, is there a statistically significant difference between the acculturative stress level, as measured by the ASSIS, between SIUC international students who utilized the researcher-provided website and those SIUC international students who did not access the website?

Significance:

At SIU in 1999 there were 1, 342 International Students, representing 6% of the overall student population of 22, 323 (Figures from Fall 1999). They bring cultural and linguistic diversity, a global perspective, and intellectual stimulation to the American university campus. Further, as universities utilize Internet Technology more and more for attracting, retaining, teaching, and meeting the needs of its students, it behooves higher education to study the effect of technology on the International Student population. Institutes of Higher Education need to know if these students have access to these services, if they use these services in making decisions about university attendance, and if these services are effective in helping students adjust to the university environment. With this dissertation, this researcher would like to create a website which meets the special needs of International Students and study the efficacy of this use of Internet Technology.

Summary of Procedure:

April/May 2000	May/June 2000	July 2000
Focus Groups: Surveys and Meetings with International Students on campus	Triangulate data from meetings and surveys	Websites posted for one month
Purpose: To gather data regarding the content of the websites. Tentative topics include: Adjusting to the US, Adjusting to Carbondale,	Purpose: To create websites for International Students who are applying to SIU. Advertisements about websites sent via	Purpose: To create a site where International Students who are applying to SIU can seek information, post

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Adjusting to SIU, and Personal Issues.	International Students and Scholars and CESL.	questions on a bulletin board, and chat with students on campus.
August 2000 Survey of International Students. Collect information regarding: 1. Demographics 2. Accessibility 3. Stress Level (ASSIS) 4. Review of website	Sept/Oct/Nov 2000 Triangulate data collected: Statistically compare the stress level of students who accessed the website and those who did not.	Dec 2000-Mar 2001 Repeat full research procedures for students who are entering in January 2001. Repeat data collection and triangulation.

Anticipated Outcomes, Results or Conclusions:

This researcher anticipates that the data collected will provide valuable information to the university and to research in Internet Technology. It is anticipated that the data will reflect the efficacy of Internet Technology to meet the needs of International Students at SIU. Specifically, participants will report their level of access, their use of such material, and how well this material ameliorates the effects of cultural transition. Hopefully this information will lead to further research in this area so that universities can delve deeper into the effects of online information on their International Student population. The final paper results will be completed by April 13, 2001.

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On Good Interface For Better Web

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Abstract: Internet and World Wide Web are finishing the process of "graduating" from being limited on research, scientific systems to being a practical, everyday technology. The main advantage of WWW is that it brings data, no matter what kind, closer to the user, and user closer to the information resources. Still, this is too often done using servers' basic services in the way and quantity that its owner intends. In order to give more power to larger group of users, services should be adjusted, individualised and personalised. We can not wait for servers to do this. We have to act ourselves, involve "machine thinking" and artificial intelligence into their behaviour and maximize creativity of a user through minimising communication burden of a user. All of the elements of "intelligent" behaviour have their specialised and highly useful meaning in the field of interface design.

1. Introduction

The fusion of computers and electronic communications has the potential to dramatically change and enhance the quality and "productivity" of everyday life. Besides, growing of WWW usage throughout the physical *and* logical world, one thing became rather obvious. One of the most remarkable changes in the computer world was neither in hardware, nor software area, but in interface design concept. A Graphical User Interface or GUI, that has since "invention" been implemented with alteration on a variety of platforms and operating systems, has changed our working environment a lot. Besides, originally introduced to provide a visual metaphor for an operating system, it has changed in a meantime our life and culture very much. Multi- and inter-cultural research, psychological and pedagogical studies all gave their injections to the field of interface design. Using computers became a multi-layered, interactive experience. Using WWW gave a strength of the free interaction with virtual scenes, providing opportunity to explore the same place repeatedly, building the understanding (see Winn 1992).

There is one thing concerning modern computers that is supposingly a solved problem, one generally accepted metaphore: computers should be graphics-based and human oriented. This is opposed to a character-based and technically-oriented paradigm, once powerful, now abandoned. Interface technology has changed, probably forever, what it means to use a computer. It also, for a majority of users, became as important as was the invention of low-cost computing itself. Somewhere close to the same level of importance, Internet and World Wide Web comes to mind. What can we do to improve a mixture of those three?

One important observation can be made in connection with the usage of World Wide Web. Hypertext organization and interconnection of Internet, confirms to a nonlinear form of presenting information, in which interlinking modules of related information are associated to a central topic. The associative links allow instant access to any of the modules, enabling cross-referencing and browsing. While on one hand this structure of information confirms to the structure of a WWW, on the other hand it is akin to the manner in which the human mind works to gather facts (see Putnik 2001a).

2. Preliminaries

"... and then, the world web of computers came...". Computers connected at first for some exact and specific needs, today used for so many other purposes. Commercial, financial, fun, or educational, they all require an excellent, easy to use and acquire (graphical) user interface. Research in scientific psychology has shown (see Card 1983), (see Norman 1988), that a person can actually pay complete attention on only one thing at any given moment. Exceptions are so few and so specific, that they can easily be ignored - at least in interface design process. If we have to, as we often do, perform several things at the moment, all but one must be automatic, routine - only one can realy be creative.

Can we ask for a standard in user-interface design process? Should we require that all web-designers follow the same manner of work? Are they designers in that case, or merely copycats? The way that one educational - for example, an important example - web-site operates, may suddenly change as you move from one page to another. Your "routine" work learned as a part of a lesson on a web-site usage at page **A**, may confuse you at page **B**. As those same papers from psychology show, since Your attention is on the content of what You are trying to do - and not on the system state - You will very possibly end up attempting to use the methods of page **A**. This will often fail, so Your attention will move away from lesson, education, problem, and be displaced from Your work to the interface itself. After resolving a problem, a person has to refocus itself again, having lost time, and often a chain of thoughts.

This is not acceptable. Currently, both at the institutions and at home, focus shifted towards life-long learning, making natural and possible for everyone to refresh, adapt and arrange their knowledge to new circumstances, to creating new jobs, or just simply moving to another job. Acquiring necessary knowledge must be as convenient as possible, person must be as little distracted as possible. That is where good user interface comes to mind. It has the significant role in creating situations, atmosphere and surroundings for "students" to get access to data, information, or in general *knowledge*, in such a way that they are able to make substantial use of them. They must learn how to search for information by themselves, get it and process it so that it is useful in their lives. This is specially true since a philosophy of different computer literacy emerged. With computers beginning to play a more important role in people's lives, a deep understanding of them become a necessity. A new concept emerges asking for teaching scientific principles, instead of alphabet and requiring problem solving, rather them memorization (see Biermann 1994).

Internet, WWW and their other services are here to stay and become inevitable part of childrens' everyday lives. Initial usage of it by teachers and their incorporation into courses even at the level of elementary school, should prepare both children and teachers for the future. It is not enough that they merely know something about them, they have to think how best it might be used in classrooms and, generally, in society (see Grabovac 2000). Information technology is becoming an important part of our lives, and there's simply nothing even barely indicating that this trend will change in the future society, where these children are going to live and work.

3. Some Suggestions

A central part of a GOOD interface design is to allow user to switch attention from interface itself, to their own task, making it an exclusive point of concentration. It is expected that one can read (and understand) large amounts of text if necessary, sometimes even modify it, as well as manipulate "small objects" on the screen. This assumes one-on-one relationship of a human to a computer. Learning from former coin-operated video game machines, a several important conclusions may (should?) be drawn:

- people will not read (too much) instructions;
- if someone do not see an important improvement in someone's learning curve in the first several minutes, someone will not use the interface anymore (or, should we say, spend another quarter);
- if there is something that must be explained and instructed, do it in short and direct way, as natural as possible.

Most of the complaints in software usage are due to failures of interface design, taken very generaly, ranging from opening the menu for installing software, to clicking on an icon for shutting down a web, or a machine. Everything considered, our present "PC" computers lost the main

characteristic that made them "personal". They became as large, as complex and complicated, as the mainframes they first displaced. To become a skilled user, a person is expected to know greatly and intimately several hundreds of settings and preferences of a system before it. Even the best software can be greatly eroded by a poor interface, poor implementation, poor system, or poor data. If a system has problems, bugs, if it crashes and is incompatible with the usual standards, it will not succeed. Any discipline that has grown to be as big a part of our lives as software, needs to develop categories to help in the understanding as well as the creation of the products (see Bushnell 1996). This is specially true in the area used by millions and millions more every day - in an active web.

A good user interface, using multimedia technology, using modern hardware and software support, supplies methods and techniques for organizing, retrieving and presenting information in a wide variety of formats. This can improve the effectiveness of education process. Through the process of learning *with* computers, it is essentially important that user interface forces user to be active and "do things". This usualy requires usage of techniques of artificial intelligence in design and implementation of educational multimedia WWW systems.

If we want succesfully to use computers and World Wide Web, we must also take into consideration characteristics of human learning process:

- it's goal-directed. People are willing to learn while they have a goal of interest in it;
- it's failure driven. Mistakes are the causes for learning;
- it's case-based. Facing a problem, people think of a similar situations they encountered, helping them in solving the problem;
- it occurs naturally by doing.

Using this approach, that can be applied not only for purposes of education, we have to build user interface system that will: create engaging environments for learning, create situations allowing student to make a mistake, give student the access to expert opinions relevant to the problem and use advantages of multimedia environment making education more realistic.

It is obvious that the "higher" the used technology and user interface is, the more limited is the access and the more knowledge is required for its' usage. Integrating the good interface into the usage of the Web, however, has more to offer than simply faster and more convenient communication and gathering of information for those who have access. By preparing a user to take advantages of what the Web has to offer, a more interactive experience can be offered, stimulating his motivation, curiosity, learning and dialog. Success of those highly depends on quality of the interface.

4. Summary

The process of user interface design challenges as much attention in the literature and in the research as the technology themselves. This unfortunately doesn't mean that there is an agreement within the field about HOW TO design user interface, or WHAT is the best method, or anything of a kind. Yet, everyone is aware of the importance of the matter. Everyone is conscious of the need that a good user interface should be a *system*, a set of related and interdependent components that work together to perform some function. The importance of this notion is that it "reminds" software planners and developers that no component of software can be overlooked, because each component contributes to the effective usage of computers.

World Wide Web brought into our lives a lot of different "medias" for information presentation. Some research shows (see Woolf 1995), that each media display, graphic, text, simulation or animation, audio or video, is connected to and identified by a person as a different representation of the same information. Evaluation of systems using different media, shows that users progress to the same mastery level of manipulating computers in one-third of the time required by conventional education. Furthermore, students using these systems show a 40% improvement over their performance from classroom instruction (see Lajoie 1992). Can we add to this number by creating better user interfaces?

We can not expect that too many of the present users, especially in the business world with all the colossal investments in the web industry, would welcome a new system of standards in interface design world. Still, we can offer and sell it to masses of new users and thousands of unsatisfied ones. More precise - this whole "story" is not about setting some new, formal standard. It's just about following the given ones, ones that will assure quality. That way, we can assure that WWW will be used not for pure fun, or enjoyment, but also for creating "collaboratory", or a virtual

laboratory created by the means of the World Wide Web: "...center without walls, in which the nation's researchers can perform their research without regard to geographical location - interacting with colleagues, accessing instrumentation, sharing data and computational resources, and accessing information in digital librarires." (see Cerf 1993). Or, if we put it in constructivist view of learning things "human learn not primarily by receiving and copying impressions and information *from* the world, but rather by constructing and reconstructing our own mental conceptions *of* the world." (see Angelo 1999).

It is a common myth that an interface is either easy to use, or easy to learn, but "never" both at the same time. There is no theoretical reason to beleive this and there are counterexa mples, and yet too many examples conforming this myth. New input/output modes such as voice, handwritting recognition (or, even mind-to-machine paradigms), mechanical gloves and 3D devices raise a lot of popular interest recently (see Raskin 1997). Still, the more important question, by my opinion is WHAT are we going to have to do, say, write or think in order to learn and read through the net. Or, even, without the net - if it is still possible to live without it. Yet, there is no way that we should consider our interfaces finished - while far better that in pre-GUI days, this should not be confused with the idea that they are optimal. And, if we don't add more to their development, it will raise more claims that "technology often exists without being used because it is perceived as adding litle or no value." (see Kouzes 1996).

Here, we also must make a clear distinction - user interfaces should not be fancy slide-shows, musical or animating experience, but quality, convenience and learning experience. Audio-visual elements can provide valuable aids for user interface systems. However, system is only useful if the user remains active and motivated, if he easily learns how to use the system and stays involved. The user needs to be challenged to reason about the material presented, by the methods it is presented with. Flashy graphics and simulations are not enough, the experience has to be authentic and relevant to the users' life. New technologies, with easy-to-use interfaces allow users to access, develop, make use of, apply and donate to the WWW world of information. Or, in other words, usage of a good user interface for accessing WWW becomes a meaningful tool in society in relationship with knowledge, with *gainging* knowledge, with *processing* it, with *expressing* it and with its *usefulness* (see Putnik 2001b). The revolution caused by the Internet is providing much needed motive and impulse for large-scale user interface development, evolution and expansion. Even with relatively slow computerization of lesser developed countries and societies, we must prepare for usage of wealth of information, knowledge and experience offered throughout the World Wide Web.

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Daskom On-Line:
User Management Implementation on Web-based Learning Application

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Abstract

Distance learning concept has recently become major issue in education. Its implementation becomes leading alternative teaching method beside the traditional way of teaching. The Department of Electrical Engineering of University of Indonesia has implemented a pilot project of distance learning on the subject of Computer Fundamental called Daskom On-Line. Daskom On-Line applies user management to arrange On-Line user registration process and to track user activities on Daskom On-Line curriculum.. The implementation of user management on Daskom On-Line in 1-month period has been recorded into a database of user registration and user access to the curriculum for the purpose of this paper.

1. Introduction

Distance Learning has been applied for many courses in various levels of education [Hartog et al 2000]. Looking at the proceedings of many educational conferences nowadays, like an EDLIN system [Nakayama et al 2000], one can see evidence of this improvement. Daskom On-Line is a new teaching method implemented in the Department of Electrical Engineering University of Indonesia on the subject of Computer Fundamental by using web-based learning principles. It aims to be the pilot project of distance learning implementation in the Faculty of Engineering, University of Indonesia (FTUI). It is expected that students will have deeper understanding on the subjects with the presence of such web-based learning version. Daskom On-Line is an asynchronous web-based learning method in which learning session relies on he user's will. It applies flexible learning model using computer-mediated communication, delivered via web and directed to be Virtual University.

2. Daskom On-Line User Management Design

Daskom On-Line user management arranges relationship between the user and the system. It keeps user data in a database system and determines user's right when user is accessing system.

2.1 User Management Design in Daskom On-Line

User data arrangement processes in Daskom On-line follow the principle of web database application in receiving and displaying user data. This web database application uses three-tiered system where web server connects the user's browser and the database server. User's right is classified based on user's access level. Administrator has the full access rights to the database server, the web server, the curriculum server and the administrator page. Student can only access the curriculum server

2.1.1 User Registration Process Design

Registration process is intended to record user's account to enable access to the curriculum server by filling in the on-line registration page. The information supplied by user the have to pass several verification conditions given by system. When the conditions met, the data will be stored.

Several functions applied to verify the registration process are as follows. The Check_NPM function requires the NPM given by user to be listed in the registered NPM eligible to take Computer Fundamental subject. The Check_Existing_Data function ensures that student can only register once with an NPM. Check_Existing_UserID function ensures that no user has the same userID with another user. Password crypt will encrypt the plain-text password given by user before storing it into the database.

2.1.2 User tracking Design

Daskom Online uses user-tracking concept by keeping user login records. These user login records will notify and track user's activities in the system so that the user's progress could be observed. The first phase of user tracking is authentication. Authentication starts when user wants to access the curriculum server.

User has to authenticate himself by giving a matching pair of UserID that will be confirmed with the recorded user authentication information. Then based on the UserID, the user tracking activity can be managed. This is done by adding a header consists of UserID in every page of the curriculum opened [Castagnetto, et al 1999].

The information used in the user tracking is the UserID , the curriculum page number and the date and time the pages were accessed. It will record the entire user's learning history based on the accessed pages.

3. Implementation Result of Daskom On-Line User Management

3.1 User Registration Data Analysis

There are 126 students from the total of 139 eligible students registered themselves into the system in 1 months period. In order to ease administrator's task, passwords are stored in plain-text form to enable administrators to retrieve the password and inform it to the user whenever needed.

3.2 User tracking Data Analysis

Authentication method used in Daskom On-line is based on a simple security system. From the user's activity tracking record, it is recognized that only 60 students accessed the online curriculum from the 126 registered. Total access to curriculum pages from November 16, 2000 to December 15, 2000 is 2680 times as shown in Fig. 1. Analysis of user tracking data will be explained further in the followings. Based on the UserID tracking, the students that accessed the curriculum have a large range in the number of access. The lowest number of access is once and the highest number of access is 289 times. The average number of curriculum pages accessed by each user is 44.67. According to the student's survey, the main reason behind this in the difficulty to access the site and the uncomfortable feelings when learning via computer. This may due to the insufficiency of computers and network facilities in the Faculty. Based on the Access date tracking, the average number of access per day is 8933 times. While based on the time of access occurred, the peak load was recorded between 1^{00} PM - 2^{00} PM with total access number is 535 times. The main reason of such analysis is to enable administrators to anticipate and maintain the system's availability in all time.

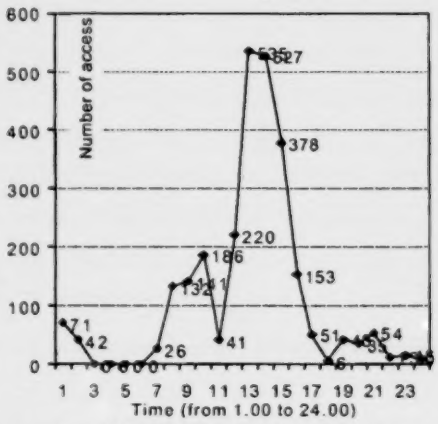

Fig. 1. Number of access based on time

4 Conclusion

The user tracking design and implementation in the Daskom Online has proven to be useful to supply important information regarding the advantage of web based learning as well as the challenging problems that emerged. Through the on-line user registration system, 126 out of 139 students has registered themselves in order to gain access to the curriculum, while only 47% is experiencing the new learning environment. Besides the technical aspects of Daskom On-line that has to be overcome, the psychological aspect also required a big attention in order to improve the sense of comfort when learning via computer.

5 Acknowledgement

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An Approach to the Development of Re-Usable and Adaptive Web Based Courses

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Abstract: We suggest an approach to the organisation and structuring of educational content aimed at tackling, in a uniform context, both problems of re-usability and adaptability of web-based instructional material. The feasibility of our approach has been analysed via an XML-based application oriented to the training of adults on Game Theory. This application is an operative example of the power of XML technology for building educational web systems which satisfy both the author's need of re-using material and the learner's need to avail him/herself of effective educational resources.

Introduction

Re-usability and adaptability of Web-based instructional material are relevant problems as to both the technical and the pedagogical points of views. On one hand, the production and maintenance of this kind of material is a highly costly process, as it requires investment in time, technological resources, professionals: thus, an approach to the production should be devised that allows to re-use the material in various educational situations. The relevance of this problem is made clear by the notable attempts to reach a standard for representing the elements of a web-based educational process (Forte et al., 1999, IEEE, 2001, Weibel et al., 1998). On the other hand, learners vary as to personal motivations, backgrounds, and learning styles: this problem is at the basis of research on systems which allow to adapt the content to be shown to the individual user (De Bra, 1998, Brusilovsky et al., 2000). Accordingly, we suggest an approach to the organisation of web-based instructional material aimed at tackling, in a uniform context both problems of re-usability and adaptability. This approach is realised by means of XML technology (Bray et al., 2000). Our proposal has been studied with reference to courses, organised as textbooks, about a mathematics topic: Game Theory. In the following, we illustrate our work, giving a description of the XML implementation.

The Educational Process

Educational processes carried out via web comprise two stage: course construction and course delivery. Course construction involves the teacher-author and the topic. The teacher, on the basis of the topic and his/her pedagogical ideas, develops the course: he/she defines the content, its structure and possible paths from one content to another, taking into account educational objectives, cognitive difficulties, prerequisites etc. Course delivery involves the student and the course. The student uses the course according to his/her objectives, difficulties, and background. Course construction is facilitated if the material developed by the teacher, can be used in a variety of courses. Thus, a clear conceptual separation between the topic and its educational value should be maintained, and tools should be given to the author to render this separation effective. Course delivery effectiveness strictly depends on the teacher capabilities the course is endowed with: it should adapt the content to the student's behaviour, and visualise it taking into account his/her attitude and preferred style of presentation. Thus, mechanisms to handle these possibilities should be provided. Let us discuss our approach to these problems.

The Course Model

We refer here to web presentations in form of textbook, that is organised hierarchically or sequentially, aimed to help a student learn a given content by reading, observing examples, solving exercises. This choice is mainly due to the case we are working on: the development of electronic material about Game Theory to be used by students who could not physically take part into a traditional course based on lectures.

The Content

The content of the course is modelled by a set of *educational objects*, each one representing a concept according to one author's view and objectives. Educational objects are defined starting from a collection of pairs. Each pair, called *weighted basic component*, comprises a *basic component*, that is a basic notion, and a *weight*, that is the cognitive contribution of the corresponding basic component within the context defined by the educational object. Basic components establish the granularity of the content; the weight of a basic component can be seen as its inherent conceptual difficulty with respect to that of the others occurring in the definition of an educational object. We call *absolute degree* of the educational object the maximum of these weights. A formal definition of educational object EO is the following:

$EO = <wbc_1, wbc_2, .., wbc_n>$ where

$wbc_i = <id_i, w_i>, i \leq n$	weighted basic component
id_i	basic component identifier (*)
$w_i \in N$ $\exists\ wbc_k \in EO : w_k = 0$	weight in EO, of the basic component identified by id_i

absolute degree $\delta(EO) = \max(\{w_i : wbc_i \in EO\})$

(*) id_i identifies in an univocal way the basic component associated to it and its value depends on implementation choices (URL, system defined references,...).

Basic components are defined independently of their educational meaning. This one is expressed by their associated weights in the context of a specific educational object, that acts as an aggregator with respect to fixed educational objectives. Two advantages derive from this approach: from one hand, the same basic component can be used to build a variety of educational object, that may be used in various courses; on the other hand, the different weights that can be assigned to a basic component give us better control on the student. For example, the definition of continuous function, which is a basic element in the formation of the concept of continuous function, is referenced in the educational object that represents the concept of derivative function. As to our educational material, basic components are definitions, theorem statements, proofs, intermediate text, exercises, ... An educational object represents the teacher's view of a concept.

Moreover, we note that educational objects are characterised by a 'regular' structure, which establishes an ordering relation on its basic components. Thus, educational objects can be defined by using a grammar expressed by EBNF notation. For example, a theorem is always given as a theorem claim followed optionally by its proof. This is reflected by the following productions:

```
Theorem::=Thc Thp?
Thc::= 'theorem claim' Lev Bcid
Thp::= 'theorem proof' Lev Bcid
Lev:: [0-9]+
Bcid::= [a-zA-Z]+ [a-zA-Z0-9]*
```

This fact leads to notable advantages as to an XML implementation, as there is a direct mapping of a EBNF representation into an XML DTD (Data Type Definition), thus facilitating the realisation of tools aimed to support the authoring of well-formed educational objects (referred to in the following also with the term object).

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The Structure

We define a course according to two different perspectives: *composition structure* and *pedagogical structure*. The composition structure refers to the content organisation with respect to exposition needs, such as sequentiality or hierarchy. For example, in our case, the compositional organisation refers to the organisation of the content in sections, paragraphs, etc... The pedagogical structure refers to the content organisation as to both the cognitive difficulties and the pedagogical relevance for the expected users. The pedagogical structure logically partitions the content of a course in *layers*. For example, in our case (Game Theory) we can have different kinds of users, for example Mathematics students, and Economics students. The courses, at least in Italy, can be quite similar, but there are notable differences as to the examples and exercises. This means that, from a pedagogical point of view, the same content can pertain to different courses with different roles.

To take into account these problems, we represent the course as a structured list of pairs. Each pair comprises an educational object, and a *layer*, which represents the cognitive contribution of that object to the course. A formal definition of course C is the following:

$C = [\langle EO_i, j\rangle : i=1,..,n;\ j=0,..,L(C);\ L(C) \leq n]$

EO_i	Educational Object
j	layer of EO_i
L(C)	layer of C

degree D of C: $D(C) = \max(\{\delta(EO_k)+j : \langle EO_k, j\rangle \in C\})$

Adapting the Course to Different Individual Needs

Given the above definition of pedagogical structure, a criterion is needed to establish accessibility, for an individual student, to the course content. A criterion can be, for example, to pass a set of tests; another one can be the content space already explored; or, it can be used a combination of these two cases. Our approach allows the teacher to select case by case the most suitable criterion. This choice facilitates the re-use and the adaptability of a course to different educational contexts and individual needs. Each *accessibility criterion* is represented by a set of *conditions* that have to be satisfied to go deeper into the course. These conditions state the accessibility to the content according to the following:

Let $\Pi = \{p_0, p_1, \ldots, p_{D(C)}\}$ be an accessibility criterion on C.

- if p_h, $0 \leq h \leq D(C)$ is satisfied then wbc_i is *h-accessible*, $wbc_i = (id_i, w_i) \in EO$, $w_i = h\text{-}j$, $\langle EO,j\rangle \in C$
- if p_h, $0 \leq h \leq L(C)$ is satisfied then EO is *h-accessible*, $\langle EO,h\rangle \in C$

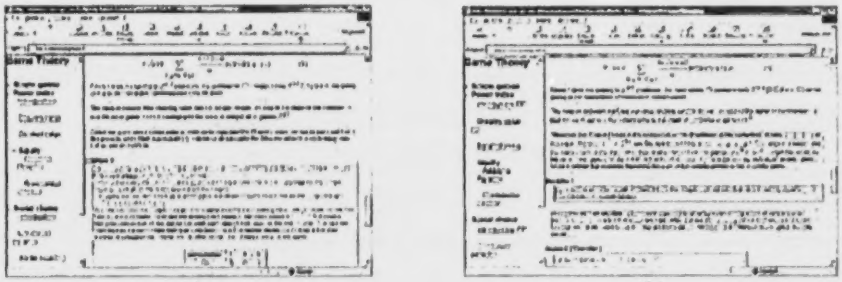
Moreover, we define the *knowledge state* of an individual student U with respect to a course C, as the tuple $\langle s,a,f\rangle$, $0 \leq s \leq a \leq f \leq D(C)$ where s represents the initial knowledge to be acquired by U, f is the target knowledge to be acquired by U and a is the *actual knowledge* of U. a is given as follows: a student U of C moves from the knowledge state $\langle s,a,f\rangle$ to the knowledge state $\langle s,a+1,f\rangle$ *if and only if* $p_a \in \Pi$ is satisfied

Based on this definition, h-accessible content (both base components and objects) can be seen as the knowledge to be acquired by a student before he/she may deal with h+1-accessible content.

Course Delivery

We focus our attention on two aspects: content presentation and navigation support As to content presentation, to make the student aware of him/her progress from a knowledge state to the successive, we express the different cognitive contributions of the basic components of an educational object highlighting them with different background colour (Fig. 1). Other aspects relating to content presentation concern both the way to capture the different types of basic components, and the way students interact with them. We adopt two complementary methods: the first is to assign different text colours to different types of components; the second concerns whether the student is given the opportunity to show or hide the content of a basic component

by clicking on its name. These features are supplied by the system, allowing the teacher to choose the best approach to adopt for the students of the course. As to navigation, we act as follows. Via the course index, which reflects the compositive structure of the course, the pages, corresponding to the educational objects, are accessed via hyperlinks. We restrict the navigation space to accessible pages, displaying as normal text (that is, hiding) links to the pages which are not accessible and colouring them differently. To help students to understand changes in the navigation space at disposal we denote links to new accessible pages with an iconic annotation (Fig. 1). The mechanism that selects the links to be hidden and those to be annotated is described in the following section.



(a) (b)

Figure 1: Views of the course according to successive student's knowledge states

The Realisation of the Model

The choice of using XML technology to realise the proposed model derives from two main considerations. Firstly, the intrinsic XML capability of specifying a language via a Data Type Definition[1] directly solves the problem of specifying the structure of the educational objects and of the course. Secondly, one of the XML fundamental assumptions, that is the separation between data and their representation, naturally reflects the needs of modelling the content of a course independently of its delivery (Bosak, et al., 1999).

Before describing the system, we anticipate that we map each educational object into a dynamically created html page, the access to which is ruled by an expandable index reflecting the structure of the course.

Representation of the Content

The page content is created by means of a XSLT style sheet that handles course content contained in XML files. Each educational object is implemented by an XML file via the declaration of an element `EO` (Fig.2). The basic components, represented by tag elements `bc`, are contained in other XML files. The number of `bc` elements per file mainly depends on the size of each `bc`. In this way we separate the structure of an `EO` (given by the list of its children elements: `df`, `td`, `tp`,...) from its physical representation, thus allowing a basic components to be referred by different objects. The 'glue' between the two kinds of files is given by two XML DTD features: the definition of external entities and the specification of ID type attributes (associated to tag elements `bc`). Thus, by using the function id() of XSLT, we can associate to each child element of `EO`, through the value of attribute `bcid`, the content of the `bc` tag element for which the attribute `id` has such value. Figure 2 shows the effect of this choice on reusability: the basic component (of type `exercise`) identified by the value `'ex83'` is associated to both EO2 and EO5 with different weights.

Via the `weight` attribute associated to each child element of an `EO`, the system selects, given an actual user's state $\langle s,a \rangle$, the a-accessible basic components. XSLT allows us to easily associate different background colours to the children elements of an `EO`, to highlight their different weights (compare Figure 1a and 1b).

[1]The presence of a DTD is not binding for the purpose of realising documents like those described by us, but is useful both for simplicity and to allow data validation by validating parsers.

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Representation of the Structure of the Course

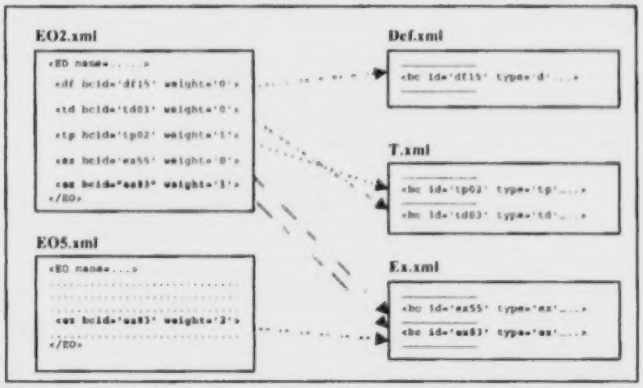

Figure 2: Schema of the course model

The course is modelled by an XML file that describes both the composition structure, by means of the tag elements `paragraph` and `educationalobject`, and the pedagogical structure, by assigning the attribute `layer` to the element `educationalobject` (Fig. 3). The association of a style sheet permits us to construct the course index that support the navigation (as illustrated in the previous section). Each item of this index is given by the `name` attribute of the corresponding `educationalobject`. When the student moves from a state $\langle s,k\text{-}1,f\rangle$ to a state $\langle s,k,f\rangle$ the system changes the course index by 1) turning the name of each k-accessible educational object into an active link; 2) augmenting all s-accessible objects (s<k) including k-accessible basic components with the icon *'new'*. This mechanism is realised, through XSLT statements, by using the value of the `layer` attribute, the value associated to the actual knowledge of the student and other parameters (i.e. the ones which implement the degree D of the course and the absolute degree δ of each educational object). All these parameters are mapped into XML-tagged structures.

```
<!ELEMENT course (paragraph|educationalobject)+>
<!ATTLIST course
        name    CDATA #IMPLIED
>
<!ELEMENT paragraph (paragraph|educationalobject)*>
<!ATTLIST paragraph
        name    CDATA #IMPLIED
>
<!ELEMENT educationalobject (#PCDATA)*>
<!ATTLIST educationalobject
        name    CDATA #IMPLIED
        eoid    CDATA #REQUIRED
        layer   CDATA #REQUIRED
>
```

Figura 3: Excerpt from the course structure DTD

Creation of the Educational Material

The authoring process comprises three phases: building the basic components, composing the educational objects, writing the index of the course. The first phase regards the writing of the content of the <bc> tag. This content consists of phrases including mathematical notations. In our case, as part of the material was already written in LaTeX, two translation steps are needed: 1) from LaTeX into HTML (through

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the LaTeX2html tool); 2) from HTML into XHTML (i.e. html well formed, through the Tidy tool of W3C). We obtain XML files like those represented on the right hand side of Figure 2. The second and the third phases are substantially independent of the kind of content, and mainly consist in the writing the tag elements of our language.

Management of the Students' Knowledge

As to the assignment of the knowledge states $\langle s,a,f \rangle$ to students, the system allows the teacher to set the starting and the final knowledge on individual or group basis by using a student administration tool (Forcheri et al., 2001). As already discussed, the way to determine these values may depend on a variety of factors and is up to the teacher. Moreover, the system updates the knowledge state of a student, when he/she satisfies condition p_a.

Concluding remarks

The diffusion of Web-based educational material can receive a notable impulse by employing standard technology as a basis to reach a twofold aim: to dynamically obtain a variety of courses starting from a set of contents and pedagogical objectives; and to build personalised educational paths starting from a course and learner's needs. Our proposal, which operatively analyses the potential of XML to realise educational system endowed with these features, constitutes a contribution in this direction.

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Towards an Interactive Programming Tutor

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Abstract: It has been suggested that it is only now, as a result of technological innovations, that the constructivist theories of education can be implemented. This school of thought advocates a more student-centric approach where the methods of teaching and learning employed more accurately reflect the way in which we learn naturally. For example, the teacher's role is facilitative rather than instructional, control of the learning process lies with the student etc. Reviews of the traditional, behaviourist pedagogies have highlighted the need for change; the demands of our society for lifelong learning, just-in-time training, distance education etc. are not being met. In the education of computer professionals, it is especially important to meet these requirements equipping them with the techniques necessary to maintain their skills in an ever-changing environment. Of particular importance to the authors is the need to learn new computer programming languages in a constructivist way as facilitated by new technologies.

Background

Unfortunately, many attempts to date to combine these pedagogic, technological and societal developments have simply adopted the so-called 'gift-wrapping' approach where technologies have been used primarily as add-ons to existing practices rather than a catalyst for fundamentally rethinking what education should be about in the next century (Fischer 1998). Implicit in the term 'gift-wrapping' is the criticism that the wrapping is more important than the gift itself. Analysis of the many programming tutorials on the World Wide Web reveals this to be the case. Of the remainder, most have remained 'unwrapped' in the sense that the WWW is used as a notes distribution mechanism without recourse to multimedia technologies or review of pedagogic appropriateness.

Collaborative Domain-Oriented Design Environments

Review of the literature to date reveals that innovative uses of computers in education have focused on two major approaches, namely Intelligent Tutoring Systems and Interactive Learning Environments (Fischer 2000). Intelligent Tutoring Systems direct the learner through a sequence of tasks allowing new concepts and skills to be introduced in what has been pre-determined to be the most appropriate order. Thus the user is guided through the material. The perceived drawbacks to this approach are a) that the learner is not in control of the environment and b) the learning is carried out in isolation i.e. the opportunity to 'situate' the learning in a real-world context of relevance to the learner is omitted. Interactive Learning Environments, in the other hand, put the learner firmly in control of their learning and thus reflects the constructivist philosophy; the direction, level of content, navigation through the material etc. is left entirely to the learner. The disadvantage to this approach is the lack of any expert tutoring or guidance such that mistakes may go undetected/uncorrected or the learner may not achieve their full potential.
The challenge therefore is to implement a learning environment which harnesses the strengths of each of these systems while minimizing the weaknesses. One such environment proposed is the Collaborative Domain-Oriented

Design Environment whose aim is to *"augment and complement human intelligence with rich computational environments including critics, agents, assistance, adaptable and adaptive tools, information access and information delivery mechanisms"* (Terveen 1995, as cited in Fischer 2000). In these environments, the learner is in control of the learning process and interacts dynamically with the system, to modify it, extend it, receive guidance from it etc.

Effective Learning

Regardless of the delivery mechanism (gift-wrapped or unwrapped) or the technological approach adopted (Intelligent Tutoring System, Interactive Learning Environment, Domain-Oriented Design Environment), the overriding objective is the education of the learner. It has been averred *"the most effective learning requires a well-defined task with an appropriate difficulty level for the particular individual, informative feedback, and opportunities for repetition and corrections of errors"* (Ericsson 1996). Learning a programming language is no exception to this and in fact, probably lends itself more to this 'learning by doing' strategy than many other topics. Unfortunately, the traditional classroom/lecture theatre setting is not supportive of this methodology.

Interactive Programming Tutors

The authors suggest that the new generation of technology-based educational offerings should be called Interactive Tutors. As the words suggest, such systems should be based on a philosophy of 'guided interaction', the technical implementation of which facilitates effective learning. Interactive Tutors would seamlessly implement the pedagogically most appropriate elements of Intelligent Tutoring Systems and Interactive Learning Environments. The criteria upon which an Interactive Tutor would be judged therefore are 1) Pedagogic Effectiveness, 2) Interactivity and 3) Guidance System. These requirements may be applied to any topic of learning. What is of particular interest is improving the current situation regarding the teaching and learning of programming languages and the development of Interactive Programming Tutors. Some work has already been carried out on teaching methods employed, prompted in part by the shift away from formal, sequential programming styles towards the new family of object-oriented, event-driven, client/server approaches, and therefore the focus of the research has concentrated on languages such as Java and C++ (Stein 1999; Stroustrup 1999). However, work to date has been carried out in the absence of any educational technology considerations; the application of the benefits of an effective, interactive, guided technology-based environment to modern philosophies of teaching and learning a programming language has not been investigated.

Conclusion

The authors are currently prototyping Interactive C Programming Tutors to investigate the feasibility of further development. The C language was chosen in the first instance, as it is a language we teach on our part-time courses and we can therefore see immediate benefits of an interactive tutor in our particular situation. Secondly, the methods of teaching sequential languages have remained essentially unchanged, even if delivered online, so an implementation of the theories espoused here using the C programming language serves as a valid comparison scenario.

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Why did they Drop? High Attrition & Instructional Design in Distance Education

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This poster/paper will report the findings of a study that describes and explores a "problem" online course in undergraduate Education – a course that saw one of two instructors quit mid-semester and student enrollment plummet almost 40%. Preliminary findings suggest that problems with the technology (including access and lack of instructor training) are responsible for the instructor withdrawal, and that the "dynamic" instructional design (i.e., frequent changes to student assignments, etc) contributed to the high student drop rate. Implications for instructional design and technical support are discussed in light of Cognitive Flexibility Theory (R. Spiro, P. Feltovitch & R. Coulson)

How Much Middle-Tier Do You Need?

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Abstract: Middle-tier-technologies have been realized to be the only useful way of controlling data-flow between the internet and databases in the intranet. In the last years there have been many different approaches to solve this middle-tier-problem. In this paper, we present a middle-tier-platform called the "Smart-Data-Server" and show its flexibility and applicability with a practical example and point out the main differences between this middle-tier platform and other approaches.

Introduction

At the beginning of the internet era nobody would have expected that the idea of world-wide-connected computers could have such a huge impact on today's information-technology (IT). Most companies and authorities had to reconsider and redesign their IT-infrastructure to fulfill the new requirements. Companies realized that the new form of IT is essential to survive and continue running their business successfully. In order to reduce costs and improve service quality authorities felt the need of introducing these new technologies to their IT-infrastructure.

When companies started connecting LANs to a big WAN and hence providing an infrastructure for client/server communication they faced a big problem: "How can clients efficiently access data on servers?" Some technologies such as Perl-Scripts and Java-Servlets on Web-Servers were supposed to provide a solution to this problem but did not provide enough flexibility. The need of using a middle-tier-architecture was obvious as more powerful technologies were required to provide a layer to control data-flow between Web-Servers and the databases in the intranet. In the last years many different approaches have been made to solve this middle-tier-problem. In this paper, we present a middle-tier-platform called the "Smart-Data-Server" and show its flexibility and applicability with a practical example and point out the main differences between this middle-tier platform and other approaches.

The Structure of the Smart Data Server (SDS)

The Structure of the SDS has been presented on the WebNet'99 [9] conference as a middle-tier platform for distributed applications but for better understanding we will introduce it shortly.

The SDS consists of three layers: the first layer is responsible for handling the requests to the server as a server-session, the second layer offers services to the components of the SDS whereas the last one contains the main functionality of the SDS in form of components. Each component can be added and removed to the server independently without affecting the other components of the SDS. The components are only allowed to communicate with the "outer-world" of the SDS via the services of the service-layer, so the SDS can be adapted to different environments only by configuring the services. The access to databases for example is encapsulated by a datastore-service. Requests towards these services are handled by special datastore-objects that can be configured by the components. The execution of the requests itself is not visible to the components that use this service. The datastore-service translates the requests to standard-SQL-statements and executes them via JDBC-connections. The datastore service does not use any vendor specific feature, which means that no specific functionality can be used. This makes it easier to switch between databases of different vendors without affecting the SDS or its components.

The components of the SDS offer services that can be accessed by clients sending requests to the SDS. The requests are well formed XML-documents [12] composed of the requested function, the parameter values and the desired result.

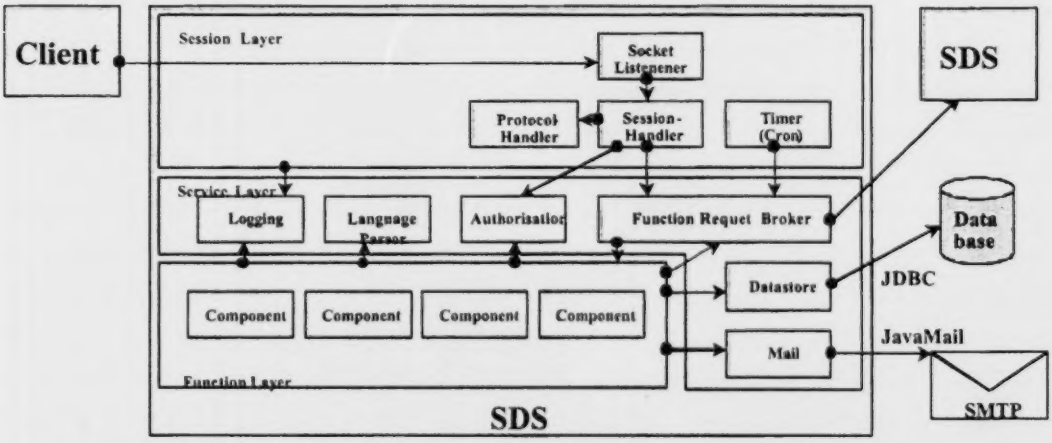

Fig.1: The internal Structure of the Smart-Data-Server.

The main advantage of using the SDS-platform as a middle-tier architecture lies in the short development time. The SDS, as a framework for building multi-tier applications, enables developers to build their applications in a very short period of time as it offers several services that do not have to be developed from the scratch.

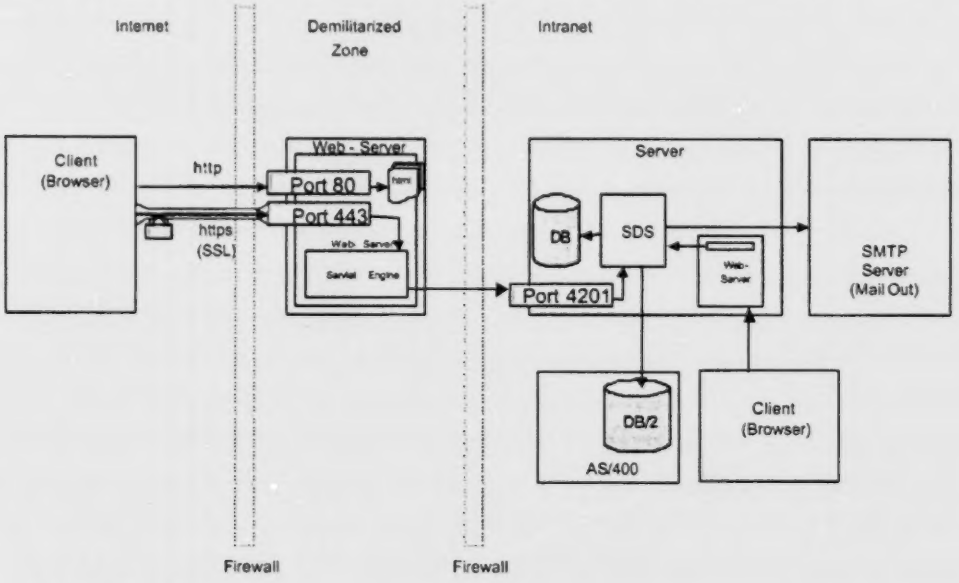

Fig. 2: First Plan.

Practical Example

The project we present in the following was a cooperation between the Institute of Telematics and the ministry of education in the state of Rhineland-Palatinate, Germany. Our main task consisted in developing an internet application to allow all the teachers in the state of Rhineland-Palatinate to extend their contracts.

Fig. 2 shows an architectural overview of the first concept.

We identified two groups of users, on the one side the teachers who send the applications and on the other side the officials in charge that are responsible for processing these applications. Due to the big number of teachers (more than 8000) we could not make any assumptions on the platforms they might be using. So we decided to

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provide a HTML front-end for our application that can be accessed by a conventional web browser running on any platform. The officials in charge can also access the system via web browsers.

A teacher fills out an online form and sends it to a servlet running on the web server, which will on its turn transfer the data to the SDS. When filling the form the web browser interacts with the SDS via servlets to provide the user with relevant information and check his/her input. During this interaction only non-critical data (such as school names, possible contract-models, etc ...) is transferred to the internet. Critical data is kept safely within the intranet.

At an advanced stage of the project we have been informed that the architecture we had designed could not be realized in its actual form due to security policy violation. In fact, the firewall between the demilitarized zone and the intranet was only opened for mail protocols and hence would not have allowed the servlets to communicate with the SDS, even if secure protocol had been used.

We had to reconsider the communication between the intranet and the internet to develop a new concept.

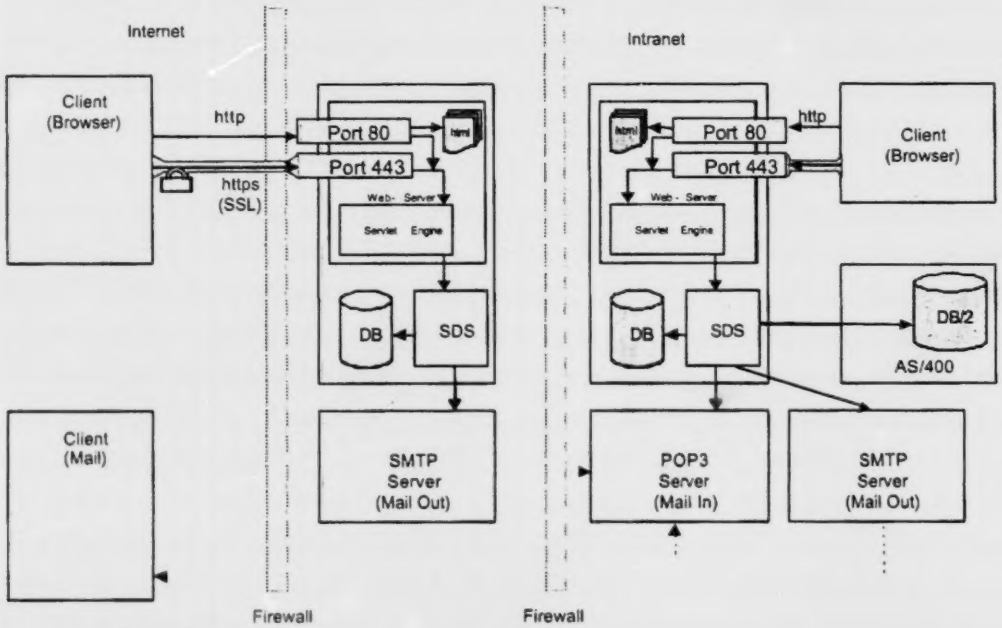

Fig. 3: Second Plan.

Fig 3 shows the redesigned architecture. The main difference to the first concept is the utilization of another SDS, referred to as "Internet-SDS", in the demilitarized zone. Instead of sending their requests to the Intranet-SDS, the servlets are now communicating with the Internet-SDS in the demilitarized zone. The structure of requests remained unchanged, only their destination had to be changed. The Internet-SDS generates an e-mail containing the requested data and sends it to the POP3 server in the intranet. Once the mail arrives at the intranet the Intranet-SDS can access it and retrieve the relevant application data. Notice that the new concept uses the e-mail protocol to fulfill the goal of storing application data in an intranet database and conform to the security policy at the same time. The flexibility offered by the SDS played a major role in reducing the changes in design and especially in implementation.

The request-syntax for addressing the "insert application"-components of the Internet-SDS and the Intranet-SDS is the same but the actions performed by the components are different. The functionality of the Internet-SDS-component consists of creating an (encrypted) email with all the application-data and sending it to an email-account owned by the Intranet-SDS. The functionality of the equivalent Intranet-SDS-Component is the insertion of the application-data into the local database. Another component had to be added to the Intranet-SDS. This component is responsible for a cyclic check of the email-account, reading, encrypting the relevant emails and requesting the "insert-application"-component.

The information about whether a request sent to the SDS should be handled by a local component or should be routed to a second SDS is held by the function request broker of the SDS and can easily be changed in the SDS-configuration-file. In case of a change of the security policy in the future that will lead to the firewall being

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opened for dedicated requests from the Internet-SDS to the Intranet-SDS, a single change of the configuration-file will route the "insert-application"-requests directly to the Intranet-SDS. The use of email to transfer data from the internet to the intranet will then no longer be used.

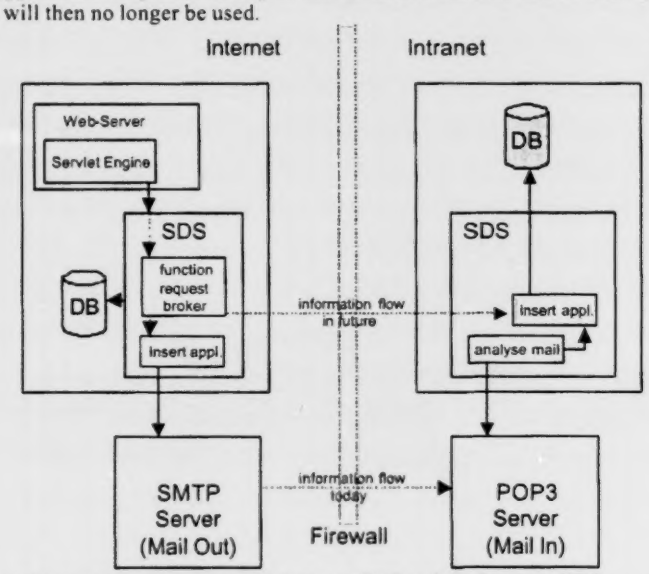

Fig. 4: Information exchange between the Internet-SDS and the Intranet-SDS.

Related Work

The SDS described in this paper represents an attempt to address the problem of building multi-tier systems for the internet. As one of the most challenging problems of today's computer industry this question has been addressed by the leading companies and organizations. Today, the most widely used and deployed distributed technologies for building multi-tier systems are the Common Object Request Broker Architecture (CORBA) [6] and Enterprise JavaBeans (EJB) [2][7]. CORBA provides a platform independent component-based distributed computing infrastructure. EJB is the Java-based equivalent technology to CORBA. It also defines a component-oriented framework for developing distributed applications. The question that raises now is: How can SDS be compared to CORBA or EJB? Can SDS be considered as an alternative to these technologies?

CORBA and EJB address the same problem as the SDS, which is developing web multi-tier applications. Another similarity is that the SDS, like CORBA or EJB, is component based. As a developer you can implement components and add them to the SDS by referencing them in configuration files. Components have to implement a specific interface to be able to communicate with the SDS.

Now let us have a closer look at the differences. Whereas CORBA or EJB provide a general infrastructure for building applications, the SDS provides a high-level framework users only need to customize to build a web application. Users are provided with a base application that can be easily extended to a complex one. Developing a web application based on CORBA means most of the time starting from scratch. Moreover, the SDS is equipped with services that can be used without any programming effort. Another major difference between the SDS and CORBA lies in the target problem field. CORBA addresses a much larger problem field, namely client/server programming in general. It also specifies vertical services that can be used when developing applications for specific fields. The SDS was designed with web applications in mind and it was meant to be used to develop web multi-tier applications. The new CORBA specification (CORBA 3.0) focuses more on internet applications. Finally, the SDS supports only pure java applications whereas CORBA applications can be developed using different programming languages such as C++ or COBOL.

Hence, the SDS can be thought of as web application server rather than an enabling technology such as CORBA or EJB. Certainly we could think about developing a CORBA-SDS or an EJB-SDS that takes advantage of these standard technologies.

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Summary and future work

In this paper we presented a multi-tier application developed using the Smart Data Server, a middle-tier-platform [10][11].

First we depicted briefly the SDS architecture. We highlighted the most important components and explained how the SDS can be used for developing multi-tier systems. Then we focused on an implementation of a practical application using the SDS. The developed system consists of two major components that are meant to be used by two user groups. The first component provides the teachers in the state of Rhineland-Palatinate, Germany, with a channel to apply for extending their contracts. The second component allows officials in charge to process the receive applications.

We explained how the SDS allowed us to redesign the system in a short time to be able to fulfill system requirements as well as to conform to the security policies of the ministry of education of the state of Rheinland-Palatinate.

SDS can be thought of as an application server for developing web applications with a specific component model. This component model is based on similar concepts as the CORBA or EJB component model. We think that redesigning SDS in the future to use a standard technology such as CORBA can improve SDS. The CORBA 3 standard addresses several problems related to development of internet applications such as firewalls or asynchronous method calls. In case of redesigning SDS it would be very useful so to use CORBA 3 and take advantage of its new services.

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We're Not Designing Courses Anymore

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Abstract: Developing standards for e-learning will have important implications for instructional designers. The most obvious change is that designers will not be designing courses anymore. They will be designing small, stand-alone units of instruction called learning objects. This will create a learning object economy that will bring new challenges as well as open new opportunities for designers. This trend will affect the instructional design process in several ways: 1) Design of instruction will focus on the creation of small, stand-alone, modular units, rather than courses; 2) Units will be designed for multiple contexts of instruction, rather than for specific training requirements; 3) Instructional content will be separated from display format, for easy customization of content; 4) Instructional content will be standardized to be interoperable with other learning management systems; and, 5) Instructional units will be tagged and held in a repository so that they can be managed, searched, and easily updated. Instructional designers will have to change their design philosophy if they are to remain competitive and profit in the e-learning market.

Introduction

Instructional designers in today's *e-learning* market are being asked to design small units of stand-alone instruction, called learning objects, that can be tagged and managed in a repository and assembled into learning modules or courses as needed (Centre for Learning Technologies, 2000). While the driving force behind this movement is concern for cost, there are implications for instructional design that may not be so obvious. Whether learning objects are built using digitized photographs, animations, text, or any other content, buyers can save money by reusing these learning objects in different instructional contexts. Sellers can profit by selling instruction over and over again to different customers. More importantly, learners will profit because instruction can be more easily tailored to their needs.

The use of learning objects in the design of instruction supports the new view that instruction should be *learner-centric*. In the near future, students will be educated and employees trained through individualized, self-paced instruction that is available anytime, anywhere, and is specific to their particular training needs. Because of the specificity of requirements, this "just-in-time" training will also be "just-enough" training that is not as lengthy as a full course and addresses the immediate training need. Building these small units of instruction will require more specific design guidance than has been available to the instructional designer in the past.

Various organizations involved in creating standards, such as the Institute of Electrical and Electronics Engineers (IEEE), are promoting architectural standards for instructional content. When these standards are implemented throughout the e-learning industry, the desire is that instructional content should run seamlessly in any learning management system (LMS). Eventually, all content, whether it is a learning object or the media associated with a learning object, will have standard descriptions or tags associated with it that will make it discoverable when it is stored in a repository. The Department of Defense (DoD) is leading the way in the development of the Shareable Content Object Reference Model (SCORM) that provides standards for instructional content, LMS interfaces, and metadata (http://www.adlnet.org).

The developing standards for instructional content will have important implications for instructional designers. The most obvious change in the design approach is that designers will not be designing courses anymore. The job of instructional designers will change in several ways: 1) Design of instruction will focus on the creation of small, stand-alone, modular units, rather than courses; 2) Units will be designed for multiple contexts of instruction, rather than for specific training requirements; 3) Instructional content will be separated from its visual display format to support multiple displays of the same content; 4) Instructional content will be standardized to be interoperable with other LMSs; and, 5) Instructional content will be tagged and held in a repository so that it can be managed, searched, and easily updated.

Design Small Modular Units that Stand-Alone

Instructional designers in today's e-learning market are being asked to design small pieces of reusable instructional content. Instead of being called course designers they will soon be called content designers, and the pieces of content they are creating are called learning objects. Sometimes the requirement will be to link several learning objects together to make a course. In other cases, it will be to create a single, small unit of instruction that will be used in a performance support context. Academic institutions and corporate training divisions are both producing this new kind of instructional material. For example, Hurlburt (2001), in an introductory statistics course, created learning objects that he called "lectlets." A lectlet was a short Web streamed audio lecture synchronized to an interactive text-graphics display. There were two to four lectlets for each chapter of the class textbook. The lectlets were accessible at any time, in any order, and were repeatable. The first 3 or 4 pages of each lectlet presented an interactive review of the previous lectlet, increasing the chance that the lectlet could stand-alone.

In order to distinguish learning objects from other content objects such as graphics or text, it is helpful to think of a learning object as a unit of stand-alone instruction. The content of a learning object should be similar in scope and nature to the content of a typical "lesson" so as to create instruction, not merely information (Downes, 2000), and it should be based upon a single learning objective (Longmire, 2000). Some learning objects will become "assignable units" in an LMS. This is the smallest segment of instruction that a learner can directly access and for which the LMS can track learner performance. Commercial best practices offer several suggestions to increase the probability and profitability of reuse of learning objects. According to Cisco Systems' strategy, a reusable learning object (RLO) should focus on a single job task and should be similar to a short lesson (Barritt, Lewis, & Weiseler, 1999). Learning objects should be independent of other content so that they can be recombined for different contexts. This means that each learning object must be able to stand alone so that confusion is not caused by references to previous topics (Centre for Learning Technologies, 2000; Quinn & Hobbs, 2000).

One practical way to design learning objects is to use formats or templates. For example, Cisco Systems requires that their learning objects contain content, practice, and assessment items. Cisco's specification also provides several standard formats for teaching various types of learning objects. Cisco's objects vary according to the type of knowledge being taught and the objective of the instruction (Barritt, Lewis, & Weiseler, 1999). Educational psychology textbooks (e.g., Crowl, Kaminsky, & Podell, 1997) often describe distinct forms of human learning, and stress the importance of tailoring instructional strategy to the individual learning needs. Standard formats have been proposed as a way to ensure uniform design quality (Merrill, 1997). More recently, Molenda (2000) has provided a model of twelve types of learning and corresponding instructional strategies and online delivery methods that could serve as the basis for a richer set of design templates.

Templates also offer a simple way to uniformly define the models of instruction used to construct stand-alone objects so that they can be utilized properly in a stand-alone mode or in the context of a larger instructional unit. For example, a commonly accepted format or template for teaching procedures would be to: 1) Present an overview of the entire procedure; 2) Demonstrate each step and identify its critical elements; 3) Coach the trainees as they practice each step; 4) Require the trainees to demonstrate the mastery of each step; 5) Integrate all steps; and, 6) Provide systematic practice toward fluent application (Thiagarajan, 1993). This procedural learning template is based upon sound, research-based learning principles, and more templates are appearing as research and practice progress. So, the use of standard templates can facilitate the creation of high quality

learning objects with understandable pedagogical strategy, making it more likely that they will be accepted and used by a majority of users.

Design Learning Objects for Multiple Contexts of Instruction

Just a few years ago, instructional designers were hired to design and develop stand-alone courses. These courses were designed so that a student could progress through several units of instruction designed for a specific context. Whether the units of instruction were called blocks, modules, lessons, or some other name, the units typically followed a linear sequence set forth by the instructional designer as the best way to impart the needed knowledge. The sequences were chronological, whole-to-part, step-by-step, or something else, but the *sequence* was part of the context that drew the units together to form a cohesive course. In order for the units to be truly sequential, they had to contain characteristics that allowed for an orderly transition from one unit to the next unit. All of this was known and practiced by good instructional designers who followed the golden rules of Instructional Systems Design (ISD). ISD is a linear and integrated process approach based upon the waterfall method of software development. ISD mandates that designers know their target audience, write and sequence performance objectives, and then design the sequence of instruction, in that order. While the ISD approach seemed adequate for the days of computer-based training, it has fostered a design strategy that is inadequate for a new distributed e-learning market that rewards reuse and repurposing of content.

From the perspective of the software engineers who are designing the standards for e-learning, it makes no difference whether a sequence of content objects is called a "course" or has a context when the content objects are chained together. But, current design practices are unduly influenced by ISD concerns about context and integration. Designing for linear sequencing and embedding context will limit the reuse of the instructional object. So, instructional designers will need to change their views on instructional design. In the real world, not all courses have an orderly and integrated sequence of instruction, or are embedded in a context. For example, in colleges and universities, there are many so-called "survey" courses in which each unit covers a topical area, but the topics are barely connected. Knowing material in the earlier units is not a prerequisite for learning the later units. A General Psychology course is a good example of such a course. A chapter on learning may contain some references to an earlier chapter on perception, but the connection is often minimal, and it is usually up to the individual instructor to provide context and determine the order and selection of chapters to be taught.

On the other hand, educational research has shown the importance of providing context to increase learning. It has been argued that meaningful learning will increase if it is embedded in the context in which it will be used (Oliver & Herrington, 2000). Situated learning environments provide context by reflecting ways in which learning outcomes are used in real-life settings. To illustrate, if emergency medical technicians are required to learn the parts of the brain, putting the required instruction in the context of an emergency situation involving a person with a head injury should facilitate learning. If context is important for learning but context limits reuse of content, then designer must consider both factors.

So, how can instructional designers provide instructional content that can be embedded in multiple contexts? Longmire (2000) suggests that the instructional designer should orient an object to its original or most likely context, but should also provide cues for learners to apply their own meanings and contexts to the information. Adding links to the learning object that point to various outside contexts is one way to do this. This way, developers may spend very little time changing the object and the learner can choose from several context options (Longmire, 2000). Longmire (2000) also suggests that it may be possible some day for an LMS to generate multiple software "wrappers," so that when a learner accesses a learning object, the context that appears will be tailored. Possibly, tailoring will be related to learner attributes. When it is possible to tailor the contextual framing of objects, the context frames must be divorced from the object (Longmire, 2000).

Separate Instructional Content from the Display Format

On the Web, content and display format appear inseparable, but in reality they may be coded separately. Various software programs provide options to change display characteristics, leaving content unchanged. The programs are similar to the software behind the "desktop theme" option in Windows that give users the

capability to change their desktop wallpaper, screen saver, fonts, and icons without changing any of the functions of the operating system. Graphical "skins" are software programs for Web applications that produce overlays that change the look of the browser. A skin does not change the way the browser application performs, only the way it looks on the computer monitor. For instance, a skin might allow users to get rid of the plain-looking gray area behind the tool bar and substitute a colorful background.

In the elearning market, instructional content must be carefully distinguished from the dsplay format. Learning object content, if it is to be reusable with minimum redesign, should allow for easy change of display format for a new instructional use. Most instructional designers who have used authoring tools for computer-based training know how easy it is to display content in various ways through the use of screen templates. The content is written with default values for fonts, font sizes, and backgrounds, but is displayed differently depending on the template that is chosen. When creating instructional content that will be Web-based, there are several ways to separate the display of the content from the content itself. One way is to use cascading style sheets (CSS), and another is to use XML Stylesheet Language (XSL). By separating the data from the presentation style, XSL and CSS provide flexible models for delivery of content in which different styles can be applied on the same data for different contexts or needs. Content structured by XSL has a self-describing quality, allowing it to be recognized by any XML-enabled LMS, regardless of the authoring environment in which it originated (Singh, 2000). The drawbacks are that XSL requires an XML-enabled LMS, and CSS requires browser support. But, the future of CSS and XML seems brighter than ever and the technologies are worth exploring.

Standardize Instructional Content to be Interoperable

Interoperability is a key component of the new e-learning environment. Sellers would have a much bigger market if their instructional content could be used by many different organizations that have many different learning environments. There are literally hundreds of very different instructional management systems and instructional authoring tools available to the developer. The obstacles to interoperability are enormous, and the ultimate solution must consider factors that deal with the learning servers, learning content and their integration. In order to make sense of this instructional chaos, EDUCAUSE established the Instructional Management Systems (IMS) Project, now called the IMS Global Learning Consortium. IMS has been working with many partners, including the DoD, to make their vision of interoperability a reality. The new SCORM reference model will rely heavily upon the developing IMS course packaging specifications. Only after the e-learning industry widely adopts some open standard will true interoperability become a reality.

Instructional Units Must be Tagged and Held in a Repository

If instructional content is to be reused widely, then the content itself must be discoverable and accessible to others. The content itself, or information about how to access the content, must reside in known repositories. In the real world, it is impractical for all instructional content or even information about content to be located in one repository. More likely than not, content and its information will be kept in a variety of locations, some of which can be freely accessed, and some of which will be for sale. New tasks for instructional designers will include going to several different repositories to find reusable learning objects and writing descriptions of learning objects they have created in the form of metadata files.

Metadata is the key to timely and meaningful discovery of existing content in a content repository. Metadata is simply a formatted file containing text that provides descriptive information about content. This information may include the format, size, delivery requirements, authorship, ownership, version number, instructional role, instructional characteristics, and type of interactivity. Sometimes an industry group will agree upon a format and a set of metadata descriptors or elements that capture the main ideas or essence of the most important characteristics of the content in a coherent and unitary fashion (Longmire, 2000). This is usually called the "core metadata" for that industry and there are numerous industry metadata standards (Quinn & Hobbs, 2000).

Metadata will be more useful if the designer uses a standard metadata schemes for tagging learning objects (Quinn & Hobbs, 2000). Each organization will have to adopt a metadata scheme and tagging rules that are appropriate for the kinds of information that it uses. For example, the DoD is in the process of developing or

adopting a standard metadata scheme for sharable content that can be used across many organizations and institutions (Quinn & Hobbs, 2000). DoD is incorporating the best practices from open standards organizations such as the IMS Global Learning Consortium (2000) and the Dublin Core (1999) to create its own set of mandatory and optional metadata elements. The Dublin Core working group has 13 super categories that make up their metadata scheme: Creator, Subject, Description, Publisher, Contributor, Date, Format, Identifier, Source, Language, Relations, Coverage, and Rights. Together, the IMS and Dublin Core sets of learning object metadata represent a set of elements that are considered fundamental by the broader learning community for describing learning resources (IMS Global Learning Consortium, 2000).

While there is little research available on metadata, there are current best practices for the development and use of metadata. For learning objects to be used intelligently, they must be labeled as to what they contain, what they teach, and what requirements exist for using them. Metadata tags often can be easily authored using a standard online form appropriate to the type of data being. Tags have a syntax that indicates the name of the field or domain of the tag, and the value attached to that label described (Downes, 2000; IMS Global Learning Consortium, 2000; Quinn & Hobbs, 2000. A word of warning--metadata should cautiously be applied to training areas that are constantly evolving since the time required to build metadata files may render them obsolete before they come on line (Schatz, 2000).

Summary

There is a new movement in e-learning for reusable instructional components. These developing standards will have important implications for instructional designers. The most obvious change is that designers will not be designing courses anymore. They will be designing small, stand-alone units of instruction called learning objects. This change will create a profitable learning object economy that will bring new challenges as well as open new opportunities for instructional designers. But, instructional designers will have to change their design philosophy if they are to remain competitive and profit in the e-learning market.

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Leaning user's interests for content-based recommender system

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Abstract: As the amount of information on the Internet increases, it becomes very difficult to find appropriate information that fits user's interests. That leads to the development of recommender systems. This paper proposes a recommendation method using content-based techniques. To complement weakness of content-base recommendation, we exploit relationship between content categories to modify the keyword weights of the categories. We implemented the recommender system for webcasting. And we performed various experiments to validate the effectiveness of the proposed methods.

Introduction

With the increasing amount of information on the Internet, it is becoming more and more important to find information relevant to user's interests. It leads to the development of recommender systems. Recommender systems use information about a user and recommend items that he is interested in to recommend items that he is likely to purchase. In recent years, recommender systems have been used in a number of different domains such as e-commerce, movies, music and web-search. The recommender system can be categorized into three types : content-based recommendation, collaborative filtering recommendation, hybrid recommendation system.

Content-based systems generate recommendations, which are similar to the items a user has experienced in his past behaviors. Although it has advantages of directness and simplicity, it has some limitations such as over-specializing problem[1] - InfoFinder[2] and NewsWeeder[3]. Collaborative filtering(CF) make a recommendation to a user based on the opinions of other users who have a historically similar taste with the user. Despite of their success, CF-based recommender systems have some limitations such as the sparsity of dataset and problem of scalability [1] - GroupLens[4] and MovieLens[5]. Hybrid recommendation[1] combines techniques of content-based recommendation and collaborative filtering recommendation to incorporate the advantages of them.

In this paper, we propose a recommendation method using contents-based techniques. In order to improve the shortcomings of contents-based recommendation, we exploit relationships between the contents category to update the user profile.

Proposed approach

The architecture of recommender system consists of the following internal modules : User interface module, Learning module for updating user profile with user's web behaviors, Recommendation module and Data storage. We have implemented the recommender system for Hanmir(www.hanmir.com) which is a webcasting site in Korea with 4 millions of user.

The learning process

In this paper, we particularly focus on the learning modules. It is very important how well the profiles can be generated and updated to improve an accuracy of recommender system. We describe the representation for user profiles and contents profile and the learning mechanisms.

Presentation

The representation for user profile and contents profile is based on the vector space model. The profiles are represented with weighted keyword vector. Our profile representations are similar to those of NewsT[6]

User profile consists of two parts. One is a category preference that represents the preference of the user on the category. It is a set of (category, weight) pairs that represent how much the user likes the contents of the category. The other is weighted keyword vector for each category. It represents user's interests in the specific category (Fig 1).

Content profile represents the features of contents. Content profile consists of several fields that are defined by recommender system. We assign a weight to the field according to its significance.

Category relations represent the relations among the categories. They are used to modify the category weights that users have not experienced. The relations can be obtained by various mining techniques and heuristics.

Learning user profile

In our approach, we create an initial profile with the preference information provided by users. To update the user profile, we capture the user's interests from the observation of web behaviors. The process for learning user's interests is as follows (Fig 2). We use the learning methods similar to NewsT[6].

- Suppose user responds to content A in category Ci, get the contents profile of A.
- Get the category relations between category Ci and other categories, and use them as learning rates of the user profile.
- Update user profile with learning rate aand user behaviors f.
- Update the category preference of user profile. Category preference is used in recommendation process

The generation of recommendation contents is similar to other methods. We use the cosine similarity between user profile and contents profile as the recommendation criterion.

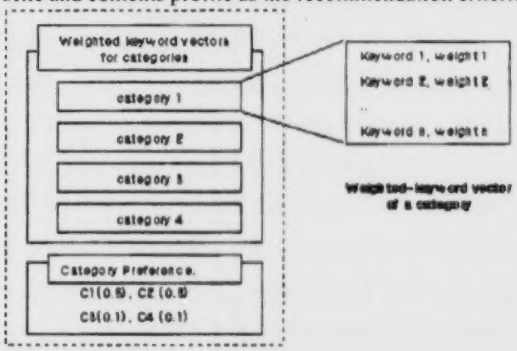

Fig 1 : User profile

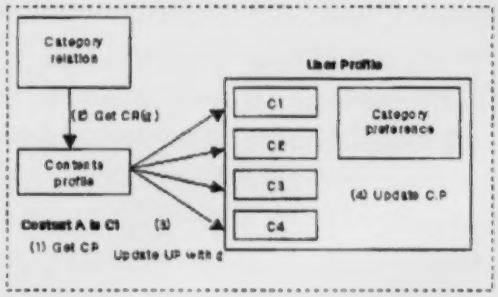

Fig 2 : the process for learning user profile

Evaluation

We have developed a recommender system using proposed content-based learning techniques. We have applied the recommender system to webcasting application to verify our recommendation method. The data set from web log of Hanmir webcasting was used as user behaviors. We selected sample data and divided the data set into a train set and a test set with 80%/20% ratio. The results show that hit ratio of our system is about 12%, and it can be improved by changing learning rate and the number of recommendation items.

Conclusion and Future works

This paper proposed a recommendation method using content-based techniques. In order to avoid over-specializing problem of content-based recommendation, we exploits relationship between content categories to modify the keyword weights of categories that have relationship with the category of contents that get user's feedback. We have implemented a recommender system using those techniques to evaluate the proposed approach. We will develop the recommender systems that can be used in general web services.

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A Spreading Activation Network Model for Online Learning Objects

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The concept of Learning Objects has been promoted by several leading and standards-setting organizations as a viable approach to standardize the creation of educational content libraries and learning management systems. An important educational question pertaining to the use of Learning Objects is: how will such objects be interconnected in order to achieve certain desired learning outcomes for each learner? This poster session presents an approach for the automatic sequencing of Learning Objects into learner-specific Learning Paths via Spreading Activation. Spreading Activation is a mechanism well-studied by cognitive scientists and that has been successfully applied for machine learning in engineered systems such as robotics. In the context of Learning Objects, the necessary metadata need to be associated with each object in order to enable the proposed Spreading Activation mechanism to automatically generate a Learning Path that is tailored to a specific learner, and leading to realizing the learner's particular learning objectives.

A Learning Objects Platform for Web-based Information Technology Education

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Abstract: Learning Objects have been promoted by several leading and standards-setting organizations as a viable approach to standardize the creation of educational content libraries. The work described in this paper presents a platform for the development of Learning Objects for undergraduate Information Technology education along four technical tracks: Network Systems, Information Systems and Support, Programming and Software Development, and Interactive Multimedia. An approach for interconnecting or sequencing learning objects in order to achieve desired learning outcomes, and the personalization of the learningexperience, for each learner is also proposed.

1. Background and Motivation

Our work is part of an ongoing effort to develop a nationally-replicable model for undergraduate information technology education.

2. A Learning Objects-based Platform

The concept of Learning Objects has been promoted by several leading and standards-setting organizations as a viable approach to standardize the creation of educational content libraries or learning management systems. Such organizations and their related activities include:

1) The IEEE (Institute of Electronics and Electrical Engineers) Learning Technology Standards Committee (LTSC): P1484 set of Working Groups and Study Groups and the resulting working documents, to-date (IEEE 2000).
2) The IMS (Instructional Management System) Global Learning Consortium: developing and promoting open specifications for facilitating online distributed learning activities (IMS 2001).
3) The US Federal Government: Advanced Distributed Learning (ADL) initiative and the resulting Shareable Courseware Object Reference Model (SCORM) (ADL 2001).
4) The European Union: PROMETEUS (PROmoting Multimedia access to Education and Training in EUropean Society) programme and the ARIADNE (Alliance of Remote Instructional Authoring and Distribution Networks for Europe) project.
5) Aviation Industry Computer-Based Training (CBT) Committee (AICC): Computer Managed Instruction (CMI) Guidelines for Interoperability (original release date 25 October 1993, Revision 34 release 23 October 2000.

As a result of these projects, a standardized approach for specifying Learning Objects and their associated metadata is bound to emerge.

Supported by a National Science Foundation grant (CCLI 2000), our work aims to develop a platform for the development of Learning Objects for undergraduate Information Technology education along four technical tracks:

1. Network Systems,
2. Information Systems and Support,
3. Programming and Software Development, and
4. Interactive Multimedia

3. Future Work

In the context Learning Objects, the necessary metadata will need to be associated with each object in order to enable the proposed Spreading Activation mechanism to automatically generate a Learning Path that is tailored to a specific learner, and leading to realizing the learner's particular learning objectives (Saad 2001, Martinez 2000).

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Technological, Pedagogical and Business Guidelines for Selecting a Learning Management System: Lessons Learned from VINCITEC

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Abstract: *This paper presents the lessons learned from the selection of a Learning Management System (LMS) for the European Software Institute's Virtual Training Center in Information Technology (VINCITEC) project. VINCITEC is a trans-European project that aims to provide reliable and critical training resources in Information Technology to Small- and Medium-size Enterprises (SMEs). The selection process of a LMS involved conducting a market survey, conducting a comparative analysis and developing evaluation criteria that include not only the technical and pedagogical requirements for the project, but the business aspects as well. We believe the lessons learned from this selection process, as well as the resulting future developments for VINCITEC that are presented in this paper, are of importance for corporations and institutions of higher education that are striving to realize the full potential of e-Learning.*

1. Background: VINCITEC

The main goal of the Virtual Training Center in Information Technology (VINCITEC) project (Vergara 2001) is to establish pan-European telematic channels to develop, test and disseminate an integrated training service (Fig. 1) on common hardware and software platforms, and to make the resulting materials available to Small- and Medium-size Enterprises (SMEs) through easy-to-use, interactive and cost-effective Web-based systems. European partners on the project include research centers, companies and universities from Spain, Austria, Germany, Italy and the U.K. (Vergara 2001). Coordination of project activities is led by the European Software Institute (ESI). The objectives of the project are to:

- Develop a Business Plan (BP) for the promotion of VINCITEC throughout the SME sector in Europe in order to bring the service to the market successfully in the space of three and a half years – since the inception of the project in 1999.
- Define a common network service using existing telecommunications platform to deliver fast, easy-to-use, integrated training service in a *virtual* environment that facilitates multimedia-based, interactive communication. This training service should narrow the gap between the information available in Information Technology (IT) today and what SMEs require to know.
- Test VINCITEC on a trial basis, working across a network of European countries that have distinctive cultural requirements, telecommunications infrastructure, and language preference.
- Identify SMEs and service providers that can promote VINCITEC (primarily throughout Europe) and/or provide suitable services for following phases of this project – beyond the project duration.

As a result, European SMEs will benefit from the transfer of innovative technology know-how in order to improve and add value to their business objectives, and to remain competitive in the European market.

2. VINCITEC's Web-based IT Courses

Online courses are currently being developed to provide training in the following *knowledge domains* that are essential to the needs of SMEs:

- *Software Process Improvement (SPI)*: the set of methods for changing the organisational software processes in order to achieve predefined business objectives. This process include different areas such as: Total Quality Management, Software Reuse, Configuration Management, Project Management, and Risk Management.
- *System Engineering*: as an interdisciplinary process that ensures that the customer's needs are satisfied throughout a system's entire life cycle. This process includes issues such as: understanding customer needs and expectations, deriving and allocating requirements, analysing of candidate solutions, evolving system architecture, system integration, verifying and validating a system, co-ordinating with suppliers, integrating disciplines, and managing system engineering support environment.

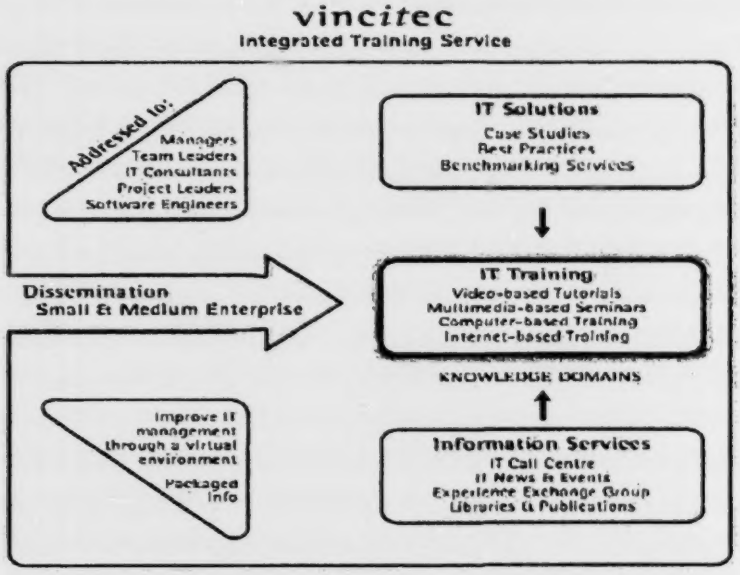

Figure 1: VINCITEC Project Structure as an Integrated Training Service

- *Software Acquisition*: this area is concerned with knowledge about acquiring a custom software system by a contracting agency from software developers that are *independent* of the agency. This area includes knowledge about acquisition activities such as procurement, contracting, performance evaluation, and providing for future support of the software system.
- *Knowledge Management*: It caters for the critical issues of organisational adaptation, survival and competence in the face of continually changing business environment. Essentially, it embodies organisational processes that seek synergistic combination of data and information processing capacity of information technologies, and the creative and innovative capacity of human beings.
- *e-Business*: Electronic Business (e-Business) is transforming traditional business operations into digitally integrated organisations. The economies of scale facilitated by this transformation allow operations to run more effectively than ever before. In other words, e-business allows organisations to increase revenues and decrease costs via the use of electronic information and an expanded market.

Within these knowledge domains, the focus of the content development of courses is on the improvement of the software development capability of a company, and the IT management skills of SMEs, as the means to achieve business excellence. A list of the courses currently being developed by ESI and its VINCITEC partners is given in Tab. 1. These courses are being developed in one of two possible delivery formats:

- The first format is *Tutorials for Senior Managers* that consist of 2-3 hours presentations on Software Management issues, in a language that the Senior Manager can relate to in *real business terms*. The objective of the tutorials is to convince senior managers of the benefits of adopting a particular technology

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that can improve the software management practices, and to clearly demonstrate to them the benefits of such practices with case studies and real life examples.

- The second format is *Courses for Practitioners*. These courses have the following features: duration of 6-8 hours (broken into modules). Focused on in-depth technical understanding of the technologies. Accessible from the workplace: both PC & Internet. Designed for interactive communication between students and a pool of experts (via mailing lists, Internet forums, chats, etc.), emphasis on practical exercises, case studies and support materials (such as templates/guides, etc.)

Course	Responsible Participant	Language
PEPIT	ESI (Spain)	Spanish / English
PRIMER	ESI (Spain)	Spanish / English
Industrialisation of Software Production	ESI (Spain)	Spanish / English
SW-CMM	ESI (Spain)	Spanish / English
UML	Intecs (Italy)	Italian / English
SPICE	ARCS (Austria)	German / English
Software Project Management	3SOFT (Germany)	German / English

Table 1: List of VINCITEC Courses

The following is a brief description of the IT courses that are currently being developed by ESI and its VINCITEC partners:

- *PEPIT - Professional Engineering Process Improvement Training*
  PEPIT is a multimedia training course on the internet with continuous support for software engineers to improve their own skills through a process centred approach in the areas of estimating, planning and tracking their work. PEPIT also introduces the aspect of quality management, based on techniques and methods for defect prevention and detection.
- *PRIMER*
  The Balanced IT Scorecard (BITS) developed at the European Software Institute is an effective communication mechanism for formulating, transmitting and agreeing on the strategy of an organisation, facilitating the alignment of improvement initiatives with the overall strategic business plan and the elaboration of a comprehensive and balanced strategic measurement system.
- *Industrialisation of Software Production*
  The reuse-based Software Factory approach developed at the European Software Institute is an effective way of increasing the software production capacity, dramatically decreasing development and maintenance costs and reducing time to market. The approach is aimed at the production of families of software systems and services, as opposed to the independent development of isolated one-of-a-kind software products. The family approach naturally leads to a "factory model" in which individual products are assembled using domain-specific components and processes fostering systematic reuse.
- *SW-CMM - The Software Capability Maturity Model® (CMM) for Senior Managers*
  The Software Capability Maturity Model for Senior Managers is a one day seminar that gives a top level view of the CMM® so that senior level managers have sufficient grounding in CMM to understand what is involved in a CMM-based Software Process Improvement (SPI) program. The tutorial is oriented to senior managers; product and technical managers representing the main business units of the organisation, and will address such issues as: how SPI can benefit the business objectives of an organisation, the tangible and intangible benefits of SPI, and to appreciate the time and effort needed to move between the CMM levels.
- *UML - Unified Modeling Language*
  To provide a complete introduction to UML and object orientation fundamentals, as well as the application of the UML notation and semantics to the development of software systems.
- *SPICE - Software Process Improvement and Capability determination*
  - Understanding SPI in general
  - General understanding of SPICE principles
  - Understanding the importance of SPI
  - Achieve the capability to practice SPICE
- *Software Project Management*
  - Know how to deal with the increasing complexity of modern software engineering
  - Understanding the key processes of software engineering
  - Introduction of some best practice solutions of software engineering

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Moreover, the following *Information Services* are also provided by VINCITEC (Fig. 1) to support *eLearning*

- *IT Call Centre*: service that provides a permanent possibility of consulting European experts in a wide range of IT issues that will be provide a service guarantee with a satisfactory answer and a 48-hour turn-around response.
- *IT News & Events*: posting provides information that is relevant and up-to-date on news that is deemed relevant to SMEs, including information on events and training courses in Europe that support the knowledge domains of the centre. This service will also provide information on networking events that would benefit the end-users.
- *Experience Exchange Group service*: whereby experts and SMEs can exchange views and information on relevant topics. This service will be organised in line with the topics covered by the training courses. It relates to the IT Solutions Services in order to provide packaged information on case studies and best practices that can be used as reference for SMEs and will be developed into a benchmarking service in the long-term.

3. Market Survey of SMEs

A market survey of SMEs was conducted in order to get a better appreciation of the *current* readiness of SME's for online training (VINCITEC Project 2001). The results of the survey were as follows:

- Most enterprises (56%) expect their expenditures in IT training to increase in the near future.
- The interest in all the training areas is balanced (excluding Software Acquisition).
- Most companies use a mix of internal and external training.
- Traditional classroom based training is more used than Computer based training. Approximately quarter of the companies use Internet based training.
- 63% of the enterprises consider e-learning opportunities in preference to traditional training courses.
- Clearly, most companies use PC/Windows or Linux platforms.
- 67% of the companies use MS Explorer and 33% use Netscape as browsers. (No other browser has been mentioned in the survey).
- Most companies have relatively high bandwidth access facilities over 128 Kbps through ISDN, ADSL or other broadband access technologies. Only 14% use traditional modems.
- ISDN is widely used in the four countries. ADSL is very implanted in Germany.
- 89% of the companies use Flat-Rate Internet access.
- Favourite e-learning aspects are in this order:
  1. Schedule Flexibility.
  2. Cost Reduction.
  3. Tracking of Students.
  4. Communication with the experts.
- Companies consider e-learning courses are similar in quality and results against traditional courses.
- Approximately two-thirds of companies would pay less for e-learning courses. One third would pay the same.

As a result of the survey, and in order to support eLearning of courses developed by all VINCITEC partners, the decision was made to acquire a Learning Management System (LMS). *Core capabilities* of a LMS that are of importance to support eLearning of VINCITEC courses include (Rosenberg 2001):

- Common online course catalog and registration system.
- The ability to track eLearning, performing learning assessment and customized reporting.
- Management of learning materials and integrating knowledge management resources.
- Supporting collaboration and knowledge communities.

4. Comparative Analysis of Learning Management Systems

The comparison of LMSs and Learning Content Management System (LCMSs) for VINCITEC has therefore involved the following two steps:

1. Obtaining information and demos for several LMS/LCMSs that are currently *in wide use* in industry and academia for eLearning, and in some cases supporting knowledge management as well, such as: IdeaSolutions , LearningSpace , Hyperwave , TopClass , CourseInfo and WebCT .
2. Contrasting the capabilities of these LMS/LCMS based on the following criteria:
   - Support for course/learning management.

- Support for content development and integration.
- Compliance to course management/computer-based training/eLearning standards (IEEE 2000).
- Support for collaboration and communications.
- Total cost of ownership: purchase/lease, installation and training.
- The requirements for VINCITEC as articulated by the project partners.

The recommendation for selecting of a LMS for VINCITEC has been mainly based on the following criteria:

a) Support for the *corporate/individual learner* as opposed to traditional student/academic learner and the academic structure of course delivery, tracking and administration.
b) Compliance (as much as *currently* possible) with eLearning/course management *standards*, for both the structure of content (including standards for metadata that should be associated with learning objects, for instance), and communications/information exchange with the LMS/LCMS. Today, *three* such standards are deemed important for VINCITEC:
    a. SCORM: Sharable Courseware Object Reference Model by the US Department of Defense's Advanced Distributed Learning initiative (ADL 2000),
    b. AICC: Aviation Industry CBT Committee (AICC 2000), and
    c. IMS: Instructional Management System by the Global Learning Consortium (IMS 2001).
c) Separation between content development from the LMS, i.e.: the ability of the LMS/LCMS to integrate content developed using "third-party" presentation software; e.g. Macromedia's, Microsoft's or Adobe's, as long as the content is compliant to the desired standard(s), such as SCORM, AICC and IMS. Such separation should also support the XML/XSL (eXtensible Markup Language/eXtensible Stylesheet Language) approach for content development (XML 2001).
d) Support for the concept of learning objects, and the corresponding eLearning standards (Martinez 2000).
e) Support for the content developer to upload courses or learning modules to the LMS/LCMS and to structure/sequence them as he/she deems it fit.
f) Support for learning customization using the *learning path* or *learning network* concept (Saad 2001).
g) *Open architecture* of the LMS/LCMS that supports its extensibility and customization via APIs (Application Program Interfaces).

Taking all the aforementioned information into account, the following decisions were made:

- An LMS or LCMS with a *pure* focus on the academic/university setting was not deemed appropriate for VINCITEC.
- The lack of *readily* available information on the capabilities of any given LMS or LCMS has resulted in excluding it from the pool of potential candidates.
- The remaining LMSs/LCMSs were then considered for further investigation.

The *most appropriate* LMS/LCMS for VINCITEC was then selected based on meeting the aforementioned criteria, as follows:

a) Its focus on the corporate/individual learner, as opposed to traditional student/academic learner and the academic structure of course delivery, tracking and administration.
b) Its compliance with emerging eLearning and course management standards, namely: AICC and SCORM.
c) Its ability to maintain a separation between content development from the LMS itself, and providing the tool(s) necessary to post to the LMS content developed by third-party software.
d) Its support for the concept of learning objects and the corresponding eLearning standards.
e) Providing Content Developers with the capability to upload eLearning content to the LMS and customizing a course sequence via programmable *dynamic actions* that can vary the sequencing of presenting learning objects to the learner.
f) Support for *learning customization* via learning objects and programmable actions.
g) Adhering to a SCORM-compliant open architecture and supporting the extensibility and customization of the LMS via various APIs.

Additional information was then requested from the vendor regarding:

- Final figures for the cost of ownership.
- Installation support.
- Support for training users, both content developers and administrators, on using and supporting TopClass.
- Continuing customer support.
- Support for acquiring future releases of the LMS/LCMS.

Moreover, it has been confirmed that issues raised by all project partners about the choice of the most suitable LMS for VINCITEC, as well as the issues pertinent to content development for online delivery using the selected LMS, have been addressed satisfactorily, including:

- Use of XML/XSL to define course material.
- Transforming XML into DHTML off-line, thereby avoiding incompatibility problems among browsers (using browser-sensitive links).
- Using third-party software (Betsy Bruce et. al 2000) seems to be a viable option to create animation.
- How does the LMS generate the navigation (menus, buttons, etc.) of a DHTML course provided by an author/content developer? Should the navigation be generated within the DHTML course, or does the LMS generate the necessary navigation? How?
- How can a DHTML-based course be integrated in the LMS?
- How can information be transmitted between the LMS and a course – in both directions? For example how can a course communicate the results of a test/assessment to the LMS? Can that be done using APIs? Is this communication based on some standard, such as AICC's?
- What is the size of screen available for, and controllable by, an e-learning course – excluding the zone controlled by the LMS for menus, frames, etc.?

5. Conclusion and Future Steps

In conclusion, once the selection of a LMS for VINCITEC has been made, project efforts have been focused on content development that adheres to sound instructional design principles and taking into account the pedagogical guidelines developed by ESI. Next steps include using the Learning Objects-based framework provided by the selected LMS for content development and investigating the use of Intelligent Tutoring Systems for VINCITEC.

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Die Neue Lehre: An On-line Course in Schenkerian Analysis

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Abstract: The interactive nature of music classes at the university level have traditionally necessitated a face-to-face learning environment. New digital technology and the increasing acceptance and use of the internet have made it possible to create effective interactive, multi-media activities for students to access and utilize on-line. In the music discipline, computers have been used effectively to augment undergraduate courses, providing computer-assisted drills and delivery of facts and knowledge mostly for music history and appreciation, and elementary music theory and aural skills. With the opportunity to connect professor to student using the internet, other more advanced courses may now be offered to remote students. Here a course in Schenkerian Analysis, an advanced type of graphic music analysis, developed by Austrian music theorist, Heinrich Schenker (1868-1935), has been adapted for the web using WebCT, a platform for delivering courses on-line. Noteworthy are the innovative method for displaying the Schenkerian graphs, employing notation software, Music Press, the animations which manipulate the graphs, and the unique opportunity for students in other counties to interact with top Schenkerian scholars at the University of North Texas.

Introduction

Heinrich Schenker (1868-1935) was an Austrian music theorist who developed a method of analyzing music in terms of structural levels and their relationship to one another (foreground, middleground, and background). Since most of the authorities on Schenkerian analysis reside in America, a course had been proposed to expose students in other countries to this unique form of analysis. The pedagogy of Schenkerian analysis itself is complex. It is generally agreed that a teacher or facilitator is necessary in order for students to grasp the basic concepts and graphing techniques. Previously, such interaction has been difficult in any but a face-to-face arrangement with students, but with the distance learning options presently available via the Internet and related technologies, more advanced courses that require direct interaction with a teacher are now possible. Through this project I have developed a distributed learning course to teach Schenkerian analysis to students anywhere in the world.

With the proliferation of Schenkerian theory in the US, Great Britain, Israel, Finland, for – increasingly – mainland Europe in the past quarter century, the pedagogy of Schenkerian analysis has become an important issue. Schenker himself was suspicious of textbooks with their tendency for artificial codification and over-simplification; rather, he recognized that his "New Teaching" ("Die neue Lehre") - as he and his students referred to it – would require a different, more "organic" pedagogical approach that was both personal and yet accessible to a wide audience.

New digital technologies have made it possible to disseminate Schenker's pedagogical approach, not through textbooks, but by adapting interactive techniques of Web-based instruction. In practice, Schenker's "new teaching" was as organic as his theory itself - and as novel in the connections it sought to draw between the individuated disciplines of theory, musicology, composition, and performance. The interactive and multi-media components of Web-based instruction enable us to realize Schenker's own pedagogical approach to instruction in Schenkerian analysis.

I have created an online course with a variety of components to make learning Schenkerian analysis possible. The webpage, created for use with WebCT version 3.0 (Web Course Tools), a platform for distributed learning courses, contains Schenkerian graphs with explanation and study questions by celebrated Schenkerian scholar, Dr. Timothy Jackson, professor of music theory at the University of North Texas. I have set his original graphs using a graphic notation program called Music Press, and then converted them to web-ready graphics files of unparalleled superior visual quality. Students learn about basic graphing techniques through musical examples, and

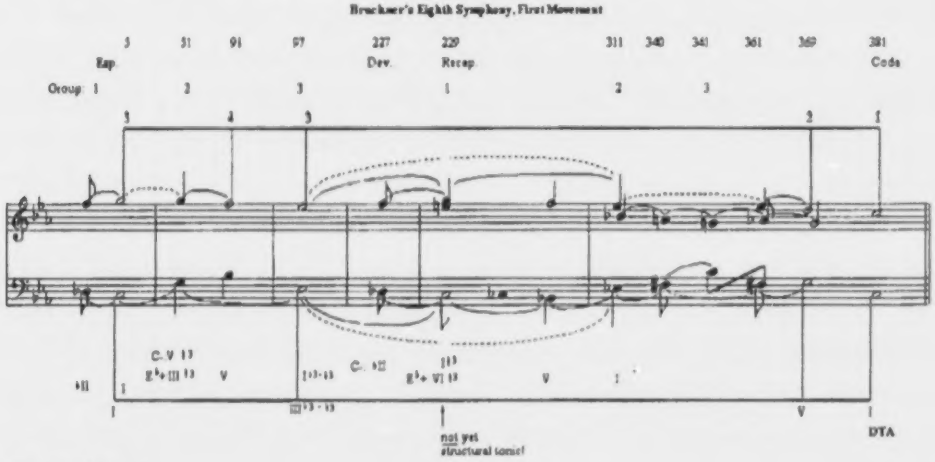
they practice applying these techniques in their assignments with interactive activities created using Flash software. Assignments are begun with initial guidance from the instructor, and then scanned in and sent to the instructor as email attachments or faxed. The instructor posts the graphs in the public forum with critiques, and the class is encouraged to participate in a virtual discussion in periodic scheduled "chat" events. There are also pre-recorded videos of the instructor explaining certain concepts, and students are able to communicate with the instructor through WebCT-unique email. Grade evaluation is based on class participation, that is comments posted and assignments submitted, as well as an individual research and analysis paper presented at the end of the term. Students also complete timed multiple-choice quizzes which are graded automatically using WebCT software, emphasizing time-on-task qualifications, as well as immediate feedback, two crucial elements to the mastery of a new technique. Each of these components add to the student's progress in the field of Schenkerian analysis.

Course Objectives

1. The students will create Schenkerian style graphs for the purpose of analyzing and interpreting music.
2. Students will recognize and describe the work of Heinrich Schenker, commentaries on his work, and recent field work in the area of Schenkerian thought.
3. Students will be able to apply analytical elements of Schenkerian thought to the literature of the established musical canon, and critically evaluate Schenkerian graphs.

Web Site Content (WebCT)

- Syllabus
- Interactive class calendar
- Interactive assignments
- "Hands-on" activities
- Real-time net chat "events" and bulliten board postings
- Schenkerian graphs made with Music Press converted to .PDF format

Figure 1: Example of a Schenkerian Graph – *Dr Timothy Jackson, University of North Texas*

Course Procedures

- Students register online for the class through UNT according to the normal Center for Distributed Learning registration process.
- Net chat "events" are scheduled; students' graphs will be scanned in, posted, and discussed with students and professor in real-time and with bulliten board postings.
- Students send homework assignments to professor via fax, sent as saved PDF files in email as attachments, or in the mail.

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- Professor posts assignments online with critiques for the whole class to see and posts his own graph with explanation.

Conclusion

There are two primary reasons for creating a distributed-learning course for Schenkerian analysis. It allows people in remote locations, who may not normally have the opportunity to do so, to learn Schenkerian analysis, and local students have the option of working at their own pace, and access to Schenkerian graphs and course materials anytime, day or night, from any computer that has an Internet connection.

End-user Web Automation: Challenges, Experiences, Recommendations

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Abstract

The changes in the WWW including complex data forms, personalization, persistent state and sessions have made user interaction with it more complex. End-user Web Automation is one of the approaches to reusing and sharing user interaction with the WWW. We categorize and discuss challenges that Web Automation system developers face, describe how existing systems address these challenges, and propose some extensions to the HTML and HTTP standards that will make Web Automation scripts more powerful and reliable.

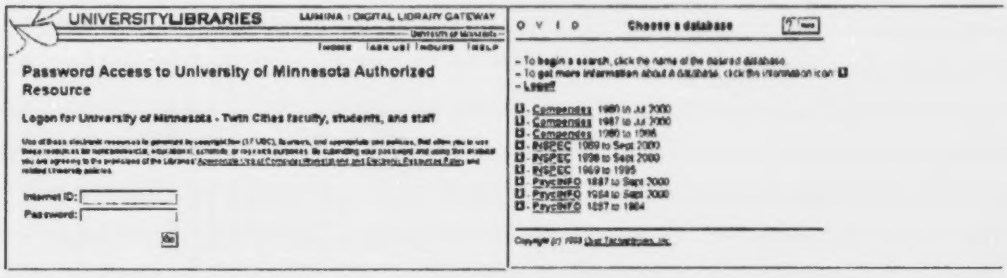
Keywords: Web Automation, end-user scripting, PBD

Introduction

From its first days, the World-Wide Web was more than a just vast collection of static hypertext, and now its character as a Web of interactive applications is essentially defined. A significant number, if not a majority, of what we think of as "Web pages", are not stored statically, but rather generated on request from databases and presentation templates. Web servers check user identity, customize delivered HTML based on it, automatically track user sessions with cookies and session ids, etc.

Interaction with the Web has become more complex for the user, too. One has to remember and fill out user names and passwords at sites requiring identification. Requesting information such as car reservations, flight pricing, insurance quotes, and library book availability requires filling out forms, sometimes complex and spanning several pages. If a user needs to repeat a request with the same or somewhat different data, it must be entered again. We claim that there are tasks involving Web interactions that are repetitive and tedious, and that users will benefit from reusing these interactions and sharing them. Interactions can be reused by capturing (recording), and reproducing them. We illustrate the repetitive aspects of interacting with the Web and potential for reusing and sharing tasks in the examples below.

A typical scenario of interaction with a Web information provider may involve navigating to the site's starting page, logging in, providing parameters for the current request (which can be done on one but sometimes several pages), and retrieval of results, such as the list of available flights or matching citations. Figure 1 shows a typical session with the Ovid citation database licensed to the University of Minnesota. The login page is bookmarked directly; no steps to navigate to it are shown.


UNIVERSITY LIBRARIES
LUMINA : DIGITAL LIBRARY GATEWAY
Password Access to University of Minnesota Authorized Resource
Logon for University of Minnesota - Twin Cities faculty, students, and staff
Internet ID:
Password:
OVID
Choose a database
- To begin a search, click the name of the desired database.
- To get more information about a database, click the information icon
- Level
Compendex 1980 to Jul 2000
Compendex 1987 to Jul 2000
Compendex 1980 to 1986
INSPEC 1969 to Sept 2000
INSPEC 1898 to Sept 2000
INSPEC 1969 to 1995
PsycINFO 1887 to Sept 2000
PsycINFO 1954 to Sept 2000
PsycINFO 1887 to 1964

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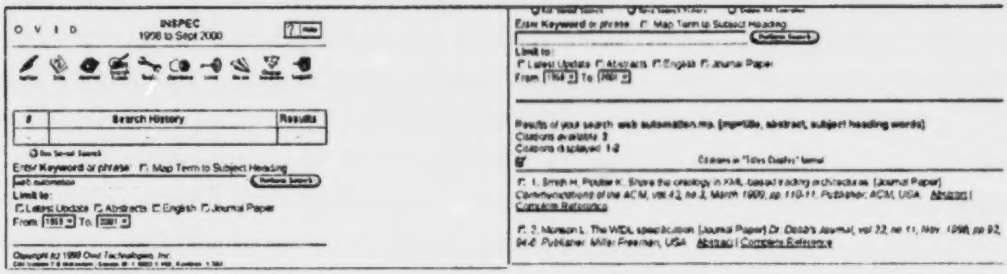

Figure 1: A Session with the Ovid Citation Search

Since the citation database changes, the user performs the citation search multiple times, perhaps on a regular basis. The interaction can be repeated exactly or with variations. For example, the user may be interested in new articles by the same author and enter the same author name. Alternatively, the user may specify different keywords or author, which can be thought of as parameters of the interaction.

Reuse of Web interaction is not limited to a single user. Consider a scenario in which a college lecturer determines a set of textbooks for a class she is teaching. She recommends that her students purchase these at Amazon.com. To make it easier for students to find the books and complete the purchase, she would like to be able demonstrate the interaction with the bookstore using her browser: navigate to Amazon.com home page, perform searches for desired books, and place them in a shopping cart. If these steps can be saved and replayed by students, they will instantly get a shopping cart filled with textbooks for the class.

Citation searches, flight reservations, rental and car classifieds are all examples of hard-to-reach pages [2] that are not identified by any bookmarkable URL, but must be retrieved by a combination of navigation and form filling. Traditional bookmarks do not address the problems with hard-to-reach pages, since they use static URLs to identify pages. Bookmarks are unaware of any state (typically stored in cookies) needed for the server to generate the desired page, so sharing and remote use of bookmarks are limited. Finally, bookmarks do not notify the user when the bookmarked page has changed in some significant way, for example, when new citations have been added to a personal publications page.

Users can automate repetitive interactions with the Web by demonstrating actions to a system that can capture and replay them. Tools to automate traditional desktop applications, such as word processors and email clients, have been available for years. They range from simple macros in Microsoft Office to sophisticated Programming By Demonstration, or End-user Programming systems that use inference, positive and negative examples, and visual programming to generalize user actions into scripts. The WWW is a different environment for automation compared to office applications, the main differences being the dynamic nature of information on the Web and the fact that servers are "black boxes" for a Web client. In this paper, we consider the challenges of automating the Web, based on our experiences developing the WebMacros system and studying Web Automation systems.

End-user Web Automation is different from the automatic Web navigation and data collection by Web crawlers, or bots, in that the former is intended to assist end users, who are not expected to have any programming experience. Developing Web crawlers, even with available libraries in several programming languages and tutorials, still requires understanding of programming, the HTTP protocol and HTML. End-user Web Automation also differs from the help that individual sites give users in managing hard-to-reach pages. For example, Deja.com provides a "Bookmark this thread" link for each page displaying messages in a specific newsgroup thread. With Web Automation, users should be able to create and use scripts that combine information from different sites, perhaps competing ones.

The rest of paper is organized is follows. First, we categorize and discuss challenges in end-user Web Automation. Second, we describe the approaches in existing Web Automation systems that address some of

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these challenges. Finally, we offer recommendations for standards bodies and site designers that, if implemented, will make Web Automation more powerful and reliable.

Web Automation Challenges

We have identified four types of challenges that developers of Web Automation system face. The first challenge type is caused by the fluidity of page content and structure on the WWW. The second type is the difficulty of Web Automation systems to reason and manipulate script execution state and side effects, since these are hidden in the Web servers. The third type is explained by the WWW being almost exclusively a human-oriented information repository. Web pages are designed to be understandable and usable by humans, not by scripts. Finally, the fourth type of challenges for Web Automation system lies in the need to make them more flexible by specifying and using parameters in scripts.

Dealing with Change

Position-dependent and Context-dependent References

Because many sites use references that are defined by their position and context on a page, Web Automation systems cannot always use fixed URLs to access pages. For example, the desired page may be pointed to by the second link in a numbered list with the heading "Current Events"; the URL in the link may change on a revisit. On the other hand, a reference with a fixed URL and context may point to a page that gets updated on a regular basis. Examples include many "current stories" sections of online newspapers, as well as eBay's Featured Items (http://listings.ebay.com/aw/listings/list/featured/index.html). When Web Automation scripts execute, following such a URL will lead to a different page. The user may intend to use the current information; however, it is also possible that the user is interested in the content that existed when the macro was recorded.

Unrepeatable Navigation Sequences

Many sites use URLs and hidden form inputs that contain expiring and randomly generated values. Avis.com, the Web site of the car rental company, and Ovid citation search both use hidden form inputs that are generated from the current time when pages are requested. If page requests are repeated after a certain period of time, both sites detect the expired sessions and return the user login page. Amazon.com generates on first page request random tokens used in all URLs of subsequently requested pages. The implication for a Web Automation system is that scripts authored by recording user's navigation cannot be replayed verbatim - expiring and random values must be identified and their current values regenerated.

Reasoning about State

Cookie Context Dependence

HTTP was designed as a stateless protocol; however, the cookie extension allows servers to store state between HTTP requests. Pages retrieved by Web Automation scripts depend on the context stored in cookies on user's computer[1]. For example, Yahoo! Mail uses cookies with an expiration date far into to the future to identify the user, and cookies valid for several hours for the current login session. Depending on what cookies are available, retrieving the URL http://mail.yahoo.com may produce a login screen for the current user, a login screen for a new user, or the contents of the mailbox.

Ill-defined Side Effects

RFC 2068 defines that the HTTP GET, HEAD, PUT and DELETE request methods are idempotent, that is the side effects of multiple identical requests are the same as for a single requests. However, there are no standards for describing side effects of other request methods. Unlike a human who reads and understands information on a page, a Web Automation system does not have information on what side effects can be potentially caused by executing a script, or a specific step in a script. Examples of actions on the Web with side effects include:

- purchasing goods or services with the user's credit card charged (travel services at travelocity.com)

- creating a new account with an online service when user's email address is disclosed to that service
- the server determining user identity (typically from cookies) and updating its customer history database

Clearly, a Web Automation system must not execute scripts multiple times that result in the user being charged, unless this was the user's intention.

Overcoming Information Opaqueness

Navigation Success or Failure not Machine-readable

A human can determine from the login failure that she has typed an incorrect name or password, and repeat the login procedure. For a Web Automation system, a retrieved page is not labeled with "Login successful, ok to proceed", or "Login failed, please retry", or "We have been acquired by another company, please click here to proceed to their Web site". It is not trivial to program a Web Automation system to detect such conditions. Reacting to them correctly is even more challenging. Another example is when no results are returned in response to a query. A Web Automation script must detect this condition and not attempt to extract non-existent results from such a page.

Machine-opaque Presentation Media

Page contents can be in a format that is hard or impossible to parse for a Web Automation script, including images and imagemaps, browser-generated content (client-side scripting), plugins and Java Applets.

Parameterization of Web Automation Scripts

The power of a Web Automation system increases if its scripts support parameters. For example, a user may be interested in obtaining the best airfare to a specific city, but is somewhat flexible on the travel dates. Such a user is likely to repeat the same interactions with the online reservation service, supplying different travel dates. In this case, departure and return dates are reasonable parameters for a script automating this interaction. The destination airport, airline and seating preferences and all other information the user can specify are likely to remain constant. The ability of a Web Automation system can be increased if it can distinguish information used to specify what the user wants (destination city for airline reservations, author name for a citation search), and identify the user to the provider (user name, password).

Approaches for Web Automation

Dealing with Change: Dynamic Content and Structure of Web Pages

AgentSoft's LiveAgent [4] was an early proprietary Web Automation system. LiveAgent scripts are authored by user demonstrating the navigation and form-filling actions. LiveAgent introduced HPDL, an HTML Position Definition Language that described the link to be followed in terms of its absolute URL, or its number on page, text label, and a regular expression on the URL. It was the responsibility of a demonstrating the script to specify the correct HPDL in a graphical dialog.

Turquoise [5] was one of the first "web clipping" systems, allowing users to author composite pages by specifying regions of interest in source pages. Turquoise has a heuristically chosen database of HTML pattern templates, such as "**the first** <HTML Element> **in** <URL> **after** <literal-text>". Patterns describing user-selected regions on a page are matched against the pattern template database. For example, a page region corresponding to the first HTML table on a page may match the template above, by instantiating the pattern "**the first** TABLE **in** http://xyz.org **after** Contents". The template matching and instantiation algorithm, along with the carefully crafted database of pattern templates, allows Turquoise to author composite pages that are robust with respect to changes in source pages.

Internet Scrapbook [9] is another "web clipping" system, designed primarily for authoring personal news pages from on-line newspapers and other news sources. Instead of using pattern templates, it uses the heading and the position patterns of the user-selected region to describe it, so it is in theory less general than Turquoise. Internet Scrapbook uses heuristics to perform partial matching of saved heading and

position patterns with updated content. The evaluation on several hundreds of Web pages randomly chosen from Yahoo! categories showed that extraction worked correctly on 88.4% of updated pages, and 96.5% with learning from user hints.

WebVCR [2] is an applet-based system for recording and replaying navigation. The developers of WebVCR acknowledged the problems with replaying recorded actions verbatim. WebVCR stores the text and Document Object Model (DOM) index of each link and form navigated during script recording. During replay, a heuristic algorithm matches the link's text and DOM index against the actual page. WebVCR is the only system that attempts to account for time-based and random URLs and form fields in the matching algorithm. Though [2] does not discuss evaluation results, the matching algorithm in WebVCR is less generic than those in Internet Scrapbook and especially Turquoise.

Reasoning About State

WebMacros ([6], [7]) is a proxy-based personal Web Automation system we developed. One of the goals for WebMacros was to share Web Automation scripts among users, and to execute them from any computer. This required the ability to encapsulate context in the form of cookies with a recorded script. WebMacros script can be recorded in two modes. In the "safe" mode, no existing user cookies are sent to the Web (but new cookies received during script demonstration are). The safe mode is appropriate when a script will be played back from a different computer, or by another user. For example, the script to populate an Amazon.com shopping cart with course textbooks should be recorded by the instructor in a safe mode, since it will be replayed by students who should not have access to the instructor private information stored in her cookies. In the "open mode" of recording, existing cookies are used, which may allow to create a shorter script, if, for instance, a user login step can be skipped.

When a user plays a WebMacros script recorded in an open mode, she can select whether her browser cookies or script cookies are allowed. If both are used, the user can choose their priority. We acknowledge that having to select cookie options can be confusing to users, so reasonable defaults are provided in WebMacros.

Overcoming Information Opaqueness

Verifying results of script playback is important, considering the dynamic nature of information on the WWW. A limited form of machine-readable status reporting is built into the HTTP protocol response codes. A page returned by a server could be different from the one expected by a Web Automation system, yet not have an error response code. For example, in response to a query a server may return a human-readable page explaining the session has expired and the user needs to re-login, or that no results are matching the query. Since no explicit machine-readable notification of query failure is provided, a Web Automation system must resort to natural language processing of page content, or reason about the HTML structure of the returned page.

To verify that a page retrieved by a script step is the desired one, WebMacros builds a compact representation of the HTML markup of each page as a script is being recorded. At playback, WebMacros compares the recorded and retrieved pages based on their HTML structure [8]. Page structure is represented as a set of all paths in the HTML parse tree leading to text elements on the page. Path expressions are enhancing with some tag attributes, such font color and size, and "pseudoattributes", such as the column number for a <td> tag. For compactness, path expressions are hashed into 64-bit fingerprints using irreducible polynomials [1].

WebMacros determines the similarity of two pages based on the relative overlap of their path expression sets. This similarity measure only depends on HTML structure, but not on content, which means that two pages generated from the same presentation template with different data will be highly similar. Our initial experiments indicate that the threshold values of 0.5 - 0.6 reliably distinguish pages with similar structure and different content (as will be the case with template-generated pages), from all other ones. This allows to verify results of WebMacros scripts playback, and alert the user if an unexpected page is retrieved. We are conducting additional experiments on clustering pages and identifying page type based on structure, using large e-commerce sites eBay! and Amazon.

Parameterization of Web Automation Scripts

Both WebVCR and WebMacros support authoring parametric scripts, with form values as parameters. In WebMacros, all input and select elements are constant by default - these cannot be overridden when a script is played. However, when a user is demonstrating a script, she can select "Variable" or "Private" radioboxes added by WebMacros to each form element. Variable parameters use default values recorded at playback, but can be modified when a user plays a WebMacros script in an interactive mode. Private parameters must be specified by the user at playback; by default, WebMacros assumes that PASSWORD inputs are private.

How Standards Committees and Site Designers Can Help Web Automation Developers

In the previous two sections, we described the challenges of Web Automation and how existing systems addressed some of them. In this section, we offer recommendations for the standards bodies and Web site designers that should make Web Automation systems more reliable and powerful. The general approach we recommend is to extend the HTTP protocol and the HTML standard with optional header fields and tag attributes that provide additional information to Web Automation scripts. We believe that extending the standards with optional elements is less intrusive to site designers and can be more easily adopted than the switch to an XML representation.

Dealing with Change

Mark references to updateable resources

To inform a Web Automation script that a URL points to a page that get updated on a regular basis, a special attribute should be added to the <A> tag. This attribute, perhaps, "Updateable", will take on boolean values. Additional attributes can specify update frequency and the time of the last and next expected update, if known.

Mark expiring and random values

Random and expiring hidden fields can be marked by adding the boolean "MustRegenerate" attribute to the <INPUT> tag. With this information, the Web Automation system will know that for this field the current value, rather than the recorded one, should be used. An additional "RegenerateUrl" attribute may point the Web Automation system to the URL at which the server regenerates the random or expiring values. A similar approach works for random and time-based tokens in URLs: for these, the HTTP reply header should contain the "Regenerate-Url" attribute.

Include date of page template modification.

For dynamically generated pages, either the HTTP reply header, or the <HEAD> section, should designate the date of the last template modification. A Web Automation script will be able to ascertain that the same template is used during recording and playback, so script rules for extracting information from a page still apply. This is different from the information in the "Last-Modified" header, which refers to the page itself and not its template.

Reasoning About State

Annotate forms with side effect info

We propose adding a "SideEffect" attribute to the HTML <FORM> tag. The possible values for this attribute include CardCharged, CardDisclosed, ListSubscribed, and EmailDisclosed. This attribute can then be examined by a Web Automation script, so that it does not perform actions with significant side effects without notifying the user.

Identify actions to regenerate cookies

If a server requires the user or session to be identified using cookies, it should provide a URL at which these cookies can be regenerated. The server can send a "Cookie-Required" headers with the reply, identifying the cookies that must be sent with the request to complete it, and the URLs at which these

cookies can be regenerated. The header will have the following form: "Cookie-Required: SESSIONID; URL=http://www.abc.org/startsession.html".

Conclusion

Why should site designers consider Web Automation systems? We believe that, as the complexity of the Web technologies and applications grows, users will turn to personal Web Automation as one of the tools that simplifies use of the Web. Sites that cannot be easily automated by end users will be at a disadvantage compared to the sites that are automation-friendly. We are developing a set of scripts that take HTML pages or HTML templates as input, and annotate the HTML tags with the attributes we propose above. Using a simple graphical interface similar to "Search-and-Replace", a site administrator will be able to override default values of added attributes where appropriate.

We expect that some content providers, such as those providing real-time stock data, will not make their sites easy to automate (as they already obfuscate content by, for instance, returning stock quotes as images rather than text). We target our recommendations at sites for which the benefits of automation-friendliness outweigh the potential drawbacks.

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Does Multimedia and Distance-Learning (e-Learning) really make any difference?

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Abstract

A national United States research study was conducted with college freshman students from five different university campuses in Northern California and Illinois. The research study included freshman students from California State University, the California Community College system, a private University offering undergraduate, graduate, and doctorate degrees, and a campus from the Illinois State University system, also offering undergraduate and graduate degrees (See Chart No. 1, Instrument and Media Development Process).

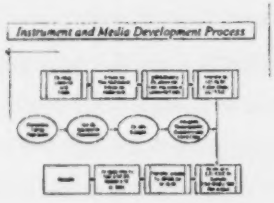

Chart 1. Instrument and Media Development Process

Purpose

More specifically, the purpose of this study was to examine the performance differences between two learning methods that is, learning by using computer-based training with multimedia and without multimedia information. Media preference factors such as learning from reading a book, PowerPoint slides, CD-ROMs, Socratic discussion, as well as delivery preference, comparing Face-to-Face (FTF) vs. Distance Learning (DL) were correlated with the two learning methods.

Procedure

Independent variables included Non-Multimedia and Multimedia presentation formats, and dependent variables included performance scores and completion times. Instruments used were a set off 10 lessons and questions for each presentation format (see Chart No. 2, Multimedia Percentages by Component), and a demographic questionnaire investigating demographic factor associations with performance scores and completion times. Lessons and questions were recorded on CD-ROMs. Floppy disk media was used to record participant performance scores and completion times. Two-way Analyses of Variance (ANOVAs) were used to calculate performance scores and completion times. Three-way ANOVAs were used to calculate performance scores and completion times to correlate with the particular media and delivery preference.

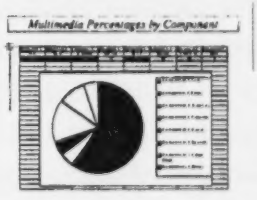

Chart 2. Multimedia Percentages by Component

Findings

This research study found significant differences in performance scores and especially, with completion times when learning with multimedia particularly, when Multimedia information was presented ahead of Non-multimedia information. When Non-multimedia was presented ahead of Multimedia information, there were no significant differences in either performance scores or completion times. However, when Multimedia information was presented ahead of Non-multimedia, performance scores, on average, did not demonstrate a significant difference, but completion times revealed a significant difference.

Completion times for the Multimedia lessons and questions took approximately 20 minutes, when Multimedia information was presented ahead of a Non-Multimedia presentation format. However, during the same sequence, completion time for completing

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the Non-multimedia lessons and questions was approximately 5 minutes, a dramatic difference. If we consider a practice effect, in having the Multimedia information first, it is still significant since the same practice effect was present when Non-multimedia information was presented ahead of Multimedia information, and still, completion time differences were not significant (p>.05).

Demographic Factors

Media preference-demographic factors such as learning from reading a book, PowerPoint slides, CD-ROMs, or learning in a Socratic discussion, showed certain differences in performance scores and completion times (See Chart No. 3, Media Preferences). The (book) and (Socratic Discussion) are still favorite media preferences.

Delivery preference that is, Face-to-Face (FTF) vs. e-Learning or Distance-Learning (DL) as a delivery preference, were also correlated with Multimedia and Non-Multimedia presentation formats. The majority of participants favored FTF as an educational delivery method.

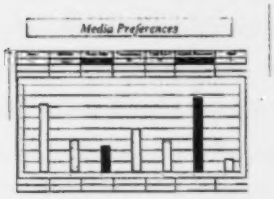

Chart 3. Media Preferences

It is important to note that the participants in this research study included only college freshman, born in 1981 and 1982; they have no recollection of our recent President Ronald Reagan, and were pubescent during the Gulf War. The participants grew up in the context of a plethora of technology, the most in human history: the ubiquitous computer, Nintendo, an endless array of software games and much more.

Yet, these same participants had a strong preference for FTF as an educational delivery method as evidenced in (Chart No. 4, Delivery Preferences). Approximately 80% of the participants favored FTF educational delivery.

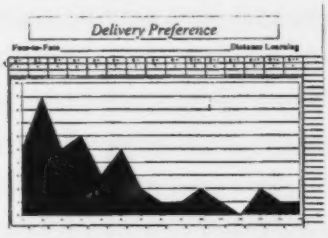

Chart 4. Delivery Preferences

However, the participants who favored DL scored approximately 10% higher than their FTF counterparts (p >.05). This is significant since this can translate to a whole grade higher on academic achievement. FTF participants are subject to the pace of the teacher and will learn at different rates and times (Gardner, 1993). On the other hand, the DL participants have the advantage of reading information online at their own pace, and may increase their propensity for achieving higher test scores.

Conclusions and Recommendations

Perhaps the most compelling result of this research study is an awareness that there are indeed, approximately 6 billion different learners on the planet and concurrently, at minimum, 6 billion different learning styles, rates, times, and timeframes in which we learn.

Clearly, Dunn & Dunn illuminate how environmental, emotional, sociological, physical, and psychological factors play an important role in our learning styles (Dunn & Dunn, 1985). Learning styles are truly like snowflakes; no two are exactly alike (Ball, 1982).

This heightens one's awareness that the educator's task to plan and execute an effective lesson for a diverse population, within a marked timeframe and budget is a formidable challenge. This research endeavored to provide the educational administrator and professional with information and tools to help ameliorate this challenge. Due to constraints of budget and time, the empirical

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data collected was limited to a sample of 44 participants from five different college and university campuses. It is suggested that a future study might include participants from a larger sample.

Multimedia and the Internet continue to evolve as an integrated learning environment in the context of a sustained growth of learners with different learning styles, who hunger for ongoing knowledge. As our learning skills develop and evolve in the context of a global magnitude, we become part of an emerging mosaic of a new and global techno-hybrid culture. As learners, we are naturally driven by an insatiable curiosity to learn about different peoples and cultures from around the world.

This research study focused on the differences in performance and completion times of non-multimedia and multimedia presentation formats. As an integral component of the research, it also examined correlations of salient demographic factors with performance and completion times of the two contrasting presentation formats.

The findings of this research study, therefore, are within the control of educational administrators and professionals alike, and certainly in the domain of timely, direct action and influence. Educational administrators and professionals in both, the private and public sector are encouraged to review these research findings for consideration in ongoing curriculum development, enhancement, and delivery.

In particular, educational administrators and professionals are encouraged to review these findings when faced with the decision-making tasks of committing to long-term capital equipment and software program expenditures. The principal benefactor must be the student.

Young people still prefer "people" to "machines". They want to meet their classmates, study with their classmates, in general, be with other students, and...even with their teachers. Distance learning is OK but perhaps...it needs to be balanced with the Face-to-Face classroom. Is it time to slow down just a bit, and take stock of where, when, and what we are?

Development and Implementation of a Field Website

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Abstract: This short paper discusses the rationale for and development and implementation of a website for the Field Education Office of a small, rural social work department. The website incorporates numerous communication functions and incorporates information, training materials and forms in multiple formats. User evaluation and feedback are discussed, as well as cost effectiveness and future innovation plans.

Introduction

Field education is an integral part of social work education, and has been since the inception of the profession. Students spend more time in field practica than they do in social work classes. Their field hours, the qualifications of their supervisors and time supervisors must devote to field education and evaluation are strictly dictated and monitored by the Council on Social Work Education (CSWE), which accredits social work education in the U. S. Field education also serves as the model for the more recent concept of service learning. This brief paper reports on the development and implementation of a multi-featured website by one Field Education Office, and the degree to which it currently can and has the potential to improve field education while reducing operational costs.

Field Instruction, Social Work Education and Technology

Kilpatrick and Holland (1993) observed that from one-third to one-half of the hours required to earn an MSW, and only slightly fewer hours toward a BSW, are spent in field practicum. While many other fields are experimenting with "service learning" components, social work field instruction has been integral to social work education since its inception over a century ago (Trattner, 1999), and has been mandated since the development of CSWE. As this suggests, coordination of field education is highly resource intensive. Our Field Education Office has contractual relationships with field sites spanning 31 counties in three states.

Prior to developing the website, it was necessary to assess the degree to which field instructors had access to computers with internet capabilities and the skills to use them. While Campbell and Queiro-Tajalli (2000) found that most field instructors did have such access, their sample was primarily urban. A survey that we conducted of the rural field instructors who would use our website found that their skills and interest were high, but their access to the internet was not as widespread. This lack was not a deterrent to developing the website, as most of the field instructors who lacked access at work had access (or greater access) at home or elsewhere. In fact, many field instructors expressed the hope that the existence of the website would spur their agencies to obtain or expand internet access. In addition, all of their student interns had access on campus, and most had access at home, as well. The project was, as a result, redesigned to serve a broader range of users, and this led to the development of a broader range of uses for the site.

Design of the Website

The Field Education Office developed its multi-featured website to reduce the time and other costs of coordinating field education as well as to increase interaction between meetings and compensate for absences. The website incorporates e-mail, including broadcast e-mail, which reduces telephone calls (and "telephone tag"), and uses a threaded discussion board for on-going exploration of specific field instruction issues. It also enables users to access the field manual, field training information and field forms online.

The website links field instructors, faculty, students and community social workers via e-mail, a listserv and a discussion board, increasing contact between face-to-face meetings, as Giffords (1998) noted were the most common and effective uses of the internet by social workers. It also incorporate links to relevant external sites. The

website enables users to access field forms in a choice of MS Word or WordPerfect formats and submit their contents online, or to print PDF versions of forms that require signatures, reducing mailing costs and the time involved in mailing and processing forms. Training materials, handbooks, course syllabi, training and meeting calendars are also be available on line. The training materials enable users to access updates in a more timely manner, with fewer mailing and processing costs; and to make up missed training or refresh themselves on training concepts they apply infrequently at any time. Online meeting calendars can be easily updated at any time, as well.

All social workers today must be prepared to use technology–and this is even more true of students who are just entering the field (Reisch & Jarman-Rohde, 2000; Stone, 1999). So, although the project was not initially conceived to incorporate student use, once this use was identified, it led to rethinking several aspects of the site design. For one, consideration of confidential uses were eliminated entirely. For another, information on field agencies, originally in plain text in the Field Manual, was instead put into a searchable database. While this information is used primarily by students seeking field placements, the format lends itself to use by workers, students and community members seeking services.

Other design changes were made in response to feedback from a pilot group of users that tested a beta version of the site. It was their suggestion to offer forms commonly used word processing formats and to break large document files into smaller components, making them easier to access on computers with slow internet connections. The pilot group also suggested using the site to inform users of c.e.u.-bearing training opportunities in the community. As all licensed social workers and counselors are required to obtain c.e.u.s annually to qualify for license renewal, and opportunities for doing so are limited in this rural region, publicizing training opportunities on the site is an excellent means of quickly sharing this information, which encourages users to check the site frequently.

Concluding Observations

Feedback about the website has been overwhelmingly positive. However, it would be unrealistic not to acknowledge existing and potential problems with its use. Clearly, the level of technology in local agencies is uneven, and it will be important to reflect that fact in future website design. While we are pleased that the project may encourage small agencies to expand the degree to which staff members have access to the internet, we recognize that this might conflict with needs for more vital client services. Some agencies have addressed this problem by obtaining cheap, used computers from other agencies that are upgrading–but this means that these computers may be very slow or have low capacities. We need to keep the project design simple and file sizes small to ensure that most users can access it.

Social work continues to lag behind the technological curve, and our rural setting reflects this fact more than most. This project is an effort to improve the effectiveness and efficiency of social work communication while using and exposing the social work community to appropriate modern technology.

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Electronically Assisting Communication for Health Professionals: engaging with digital documents

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Abstract: New information and computing technologies offer cost efficient and effective learning opportunities for health care professionals. The Assisted Electronic Communication project is prototyping, administering and evaluating a digital discourse system for health care professionals within an acute Hospital. Heath care staff participating in the study are able to access and contribute to threaded, asynchronous discussions and themed information in the context of critical work documents. Early indications are that the system is viewed very positively, and seen as a way of critically engaging with new material that is getting closer to an idealized learning in the workplace.

The Health Context

Health care systems are now looking to new technologies to effect changes their working practices and culture. Enhanced clinical performance is directly associated with the development more open and efficient communication systems, and, certainly in the UK, national priorities and funding have been directed in this way (Department of Health, 1997). In this policy context, the health care professions and particularly nursing, have seen very radical changes in respect of the demands being placed on the profession for information management.

Ongoing research at a typical UK Hospital (Brooks, et al 1998) on nursing communication and management structures has highlighted that although commitment to change is high among nursing staff, there is a need for communication systems that will facilitate the management and dissemination of information efficiently. Moreover, systems are needed that will also assist with the vital cultural and attitudinal change required to develop nurses as critical reflective practitioners who can actively participate in the process of multi-professional decision-making.

One approach to the health care 'communication and information gap' lies in the development and application of information systems that can assist in the dissemination of best practices and enhance inter-professional collaboration, (eg. Nauert, 1997). Research on Computer Mediated Communication (CMC) has identified that CMC technologies are capable of positively altering interaction patterns both in interpersonal and organizational relationships although this is dependent on the local context and culture of use being supportive of such change (McCarthy and Monk, 1994).

A critical understanding of the impact of the CMC technologies on the health care sector remains to be developed. In particular new technology systems need to be based on an understanding of health professionals communication processes and information needs. Commitment to computer based applications among health workers is likely to be higher if it is implemented in the context of a clear solution to a clinical or professional issue rather than being technology driven (Coiera, 1995). Secondly, it seems likely that the development of an understanding of how health care professionals currently (and ideally need to) communicate will prove as important as an exploration of any specialized technological communications infrastructure for health care (McCarthy and

Monk, 1994). Thirdly, existing information technologies and particularly asynchronous systems (Coiera and Tombs, 1998) such as email, internet communication tools, and text-based conferencing systems that can take advantage of communication that is threaded and themed may hold the potential for rapid, cost-effective advances in the quality of clinical information and communication for health professionals. Asynchronous electronic communication is vital to enable mobile and time-constrained professionals to communicate effectively and at convenient times. Threaded communication can establish and identify working dialogues within a collection of messages, and themed communication in a conferencing environment allows for the clear organization of information. However, above all of the technical features of such systems, the social context of the communication is significantly more important for the effective implementation of a meaningful digital discourse (Houde et al, 1998).

The Assisted Electronic Communications Project

This paper reports on an ongoing project that is prototyping, administering and evaluating a suite of systems that aim to foster digital discourse amongst health care professionals. The first of these systems helps staff within an acute NHS Hospital Trust to access and contribute to threaded, asynchronous discussions and themed information relating to the implementation of critical health policy documents.

The UK National Health Service periodically issues policy documents, which aim to regulate and standardize the practices of health care professionals nationwide. Recent examples of such publications are the National Service Framework (NSF) documents, which include for instance, an NSF for Coronary Heart Disease (CHD), an NSF for Older People and an NSF for Mental Health. Organizations such as hospitals are required to implement these frameworks by discussing and responding to these substantial documents at all levels. So for instance, in a typical acute NHS Hospital Trust, a nurse presented with a patient suffering from Coronary Heart Disease could be expected to have a clear understanding of the national standards discussed in the NSF for CHD and her own Trust's response to these directives! In a health system which is notoriously under great pressure the expectation of a deep engagement with National Frameworks is, to say the least, ambitious.

We selected a typical small town general hospital in central England - Kettering General Hospital as the site for this study and chose initially to focus on staff in the Nursing and Midwifery discipline. Previous work in this hospital (see eg. Brooks et al 2001) had provided a baseline analysis of the use of online communication (primarily email) prior to this study which is discussed briefly below. As a further focus, we selected four distinct professional contexts within an acute setting for our initial work. The four key areas selected were: Accident and Emergency, the Coronary Care Unit, a general Assessment Unit and a general Medical Ward. These locations were chosen as those with a highest engagement in the first document to be released – the National Service Framework for Coronary Heart Disease. The spaces selected in these areas all had staff rest facilities where some desk space could be found to locate a dedicated networked computer. The four selected areas cover approximately 100 Nursing staff, with very varied computer experience. No formal training in the use of the system was provided to these staff, but informal "show-and-tell" sessions were available to staff who were present when University researchers visited the areas. The machines used were designed for shared use, shift work, and without an email client available. The system in use is entirely web-browser based; with users clicking though web-pages and submitting forms in all interactions. The system is contained within the hospital Intranet, based upon a Windows NT™ server behind the NHS-Net firewall. The prototype system has been in operation at the hospital since January 2001. A detailed user evaluation, alongside an analysis of email content is being undertaken.

Professional views and experiences of CMC

A baseline survey of considered the actual usage and content of email by nurses, as well as their attitudes towards CMC. This consisted of analysis of 477 emails, depth interviews with 66 staff and a postal questionnaire to 114 nursing staff. Commitment to dissemination of information and finding a means to share information with colleagues was very high, 85% of the general survey respondents stated that it was an important or a very important aspect of their role to cascade information to colleagues. As a solution to this problem CMC was felt by the overwhelming majority to be a valuable resource by both users and non-users to achieve this. Of those whose work related to CHD 87% felt that CMC offered *improved sharing of clinical information*. Findings from this stage of the project indicated that professionals also perceived themed and threaded CMC to be supportive of discursive information sharing. The interview data indicated that CMC had the potential to develop supportive networks among isolated and time constrained staff.

"Now, there is a network of people out there that I am involved with (and) it's a way and means of actually getting the communication over more quickly and while it's there, actually in your mind. Because at the end of the day we're all human and something else can come along. ... You can think, 'I must tell Sue that' but you don't see them or can't make the next meeting." (Staff nurse, part-time, qualified 26 years)

Email specifically was perceived as offering an improved means of organizing, managing and owning the increasingly vast amounts of information that health professionals are required to deal with. Analysis of the content of emails communication demonstrated a marked pattern of evolution both in terms of a gradual increase in volume particularly at busy times, but also in terms of the type and form of information conveyed. Initially the main forms of information conveyed via email were largely simple and formally structured 'flyer' type information concerning study days and education issues or the organization of meetings. However, over the period analyzed there was increase in the amount of discursive emails, i.e. emails that canvassed views, generated discussion or attempted to progress developments. Additionally over the period these types of emails were increasingly likely to be related to clinical knowledge and practice. There was also an increased use of 'forwarding' to create basic threaded discussions. Moreover use of CMC did involve the sharing of knowledge and experiences, thereby retaining some of the strengths of informal direct verbal information. Consequently, the need to retain informality of communication and allow for discursive sharing of information were features that were specifically incorporated into the design of the digital discourse system.

Technical Directions

In this study we are integrating key features from 3 robust systems developed within the Knowledge Media Institute of the Open University into a range of clinical contexts. The overall architecture of the CMC developments is illustrated in figure 1. The first of these systems, and subject of this paper, is a digital discouse environment. This is based around server-side technologies which can augment bulletin-board-like asynchronous discussions (see for example, http://d3e.open.ac.uk/). At the centre of each discourse is an artifact, typically a document, which acts as a focus for the discussion. Contributions from participants are solicited as email or via a browser based web forms interface. The contributions are text messages which are themed and threaded, and most importantly, are in the context of the document.

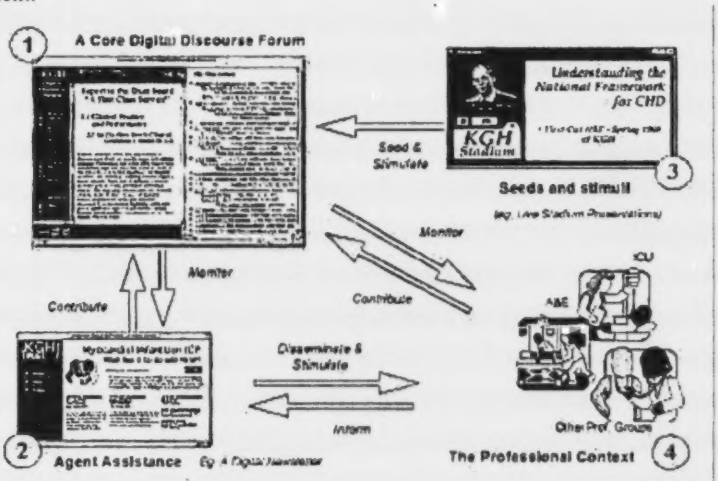

Figure 1 - The CMC architecture for the General Hospital study.

The second discourse tool is a (semi) intelligent agent which contributes to the communication. The agent is simply a server side tool which is delegated to act on the behalf of individual participants. In this case the agent can assist in the automatic production of a newsletter which is associated with the document (see for example, http://kmi.open.ac.uk/projects/planet). The third of these systems is a set of streamed media production tools that

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help to stimulate and seed the discussion by the production of both live and offline video and slideshow/multimedia presentations (see for example, http://kmi.open.ac.uk/projects/stadium).

The Discourse System

In figures 2-4 we see a selection of screenshots, taken from the discussion interfaces to the NSF for CHD.

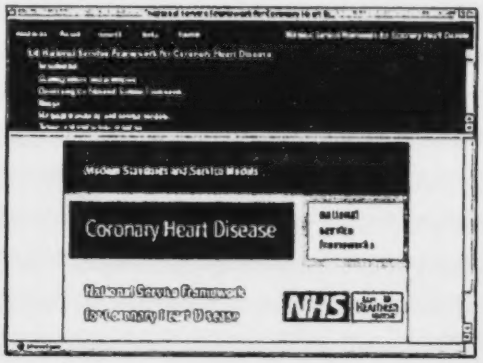

Figure 2. The front-page of the online NSF for Coronary Care.

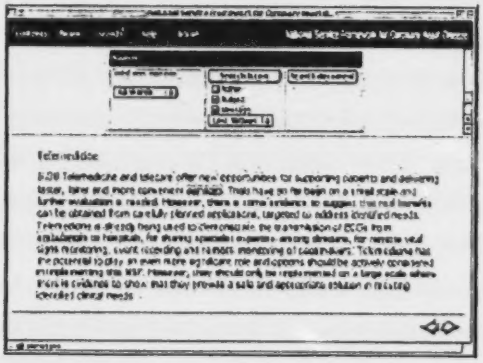

Figure 3. A document search.

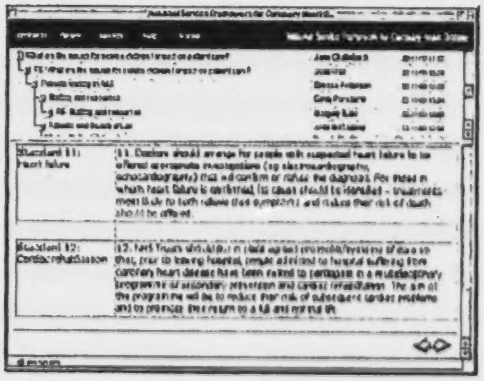

Figure 4. A threaded communication in the document.

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In the first of these (figure 2) the front page of the document is highlighted in the bottom frame, with the table of contents of the document above this, and some simple access buttons at the top. Figure 3 shows the result of a simple search of the document, in this case where the reader has looked up "ambulance" and "services" in the document itself and then chosen to view the occurrence of these terms in the telemedicine section. Finally in figure 4 we can see some of the discussion threads from the discourse forum associated with the document. Readers can view the discussion in a number of different formats to track the topics that have been raised by staff and that are linked into the document. Readers click on a thread to read the comments, and have a very simple form interface to add their own contributions. In its use, nurses have used the system for a wide-ranging discussion of the documents presented. The following two discourse samples are presented uncorrected, but anonymised from a few days in February 2001.

Discourse 1: Thrombolysis Sample

Angela (Staff Nurse - Assessment Unit) 21-02-01 15:27
Where are the policies which dictate when to give particular drugs?
Andrew (Staff Nurse - Coronary Care Unit) 25-02-01 07:52
There is a policy on CCU (April 1998) which states when tPA should be used rather than streptokinase for acute MI:
(1) for patients under 65 years with anterior MI presenting within 6 hours.
(2) patient has had strep 5 days to 5 years ago
(3) patient is severely hypotensive (<70mmHg)
(4) patient has severe allergic disease
(5) patient has strep throat infection.
Barbara (Staff Nurse - A & E) 27-02-01 08:36
is this policy avialable in a&e, mau and the wards?
Corinna (Sr. Staff Nurse - Coronary Care Unit) 28-02-01 11:15
Protocols for all cardiac conditions including when to give thrombpolysis are in all admitting areas All doctors within medicine are given the protocols on induction, with regular teaching sessions on treatment If you cannot find the policies please let me know

Discourse 2: Chest Pain Presentation Sample

Derdre (Sr. Staff Nurse - Accident & Emergency) 20-02-01 08:24
Does anyone think that it would be appropriate for all 'emergency admission' 'referrals' of patients with sudden onset of chest pain to come to A&E for assessment?
Elaine (Staff Nurse - A&E) 20-02-01 13:49
yes, so can be assessed and ref. for appropriate care or discharged under strict protocol
Frances (Sr. Staff Nurse - Assessment Unit) 21-02-01 15:45
I think that we have discussed this at this mornngs meeting, however it would also mean that you would set a precedent even for the days that we are not so busy !!
The patients are required to stay for at leastthe second CK are you suggesting they stay for the whole of that time or ??? This could impact dramatically on your trolley waits.
Glenda (Staff Nurse - Accident & Emergency) 23-02-01 00:08
Is there evidence to support that even a negative 2nd CK means that the patient is definetly not having an M.I.? I don't think that all chest pains should go through A&E. Perhaps we could develop a strict protocol about what the history of chest pain etc.

Setting aside the detailed medical content of this discourse and looking at the style of it, we can see two very different conversations happening with nurses over the involved units. The first sample is a very simple query about policies relating to Thrombolysis in which the Senior Staff Nurse, who is overall in charge of the policy, closes the simple Q-A interaction with an answer. The second is a far more complex interaction, in which a nurse from one unit proposes a policy change that would have a significant impact upon another unit!

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Summary and Future Directions

"Its been great - I said to my lot, look, if some-one as thick as me can use it, then you can do it!"
(Senior Staff Nurse, full-time, qualified 28 years)

"I am really really impressed with Jan sitting down at five in the morning and teaching Lynne how to use it. Now, I would never have seen her in that light at all - which is good, as she is going in for promotion."
(Senior Staff Nurse, full-time, qualified 20 years)

Overall acceptance of the potential of CMC to offer solutions to real clinical and health care delivery issues was very high among nursing staff. Early interactions with the digital discourse system indicate that new and developmental learning seems likely as a result of the interaction with the system, with staff sharing knowledge and 'best practice' across specialist areas.

The next phase of the project will expand the system and evaluate issues concerned with practical usage in the real clinical environment, opening it out into the entire hospital and for use by multi-professional groups. Currently, all documents in the AEC system have been added (with substantial hand-editing) by the University research team. We are now ready to release the server-side tools which will allow hospital staff (the nurses themselves), to upload of new documents without technical assistance. In addition to the National Service Frameworks we anticipate that they will use the system for a raft of other local policy documents, such as the notes of their regular "governance" meetings. Finally, late in 2001 we aim to release the integrated of agency support systems & telepresence elements. And we will then aim to explore issues around the impact of the system on the culture of the organisation.

Acknowledgements
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Graduating live and on-line: the multimedia webcast of the Open University's worldwide virtual degree ceremony.

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Abstract: As the foremost international open learning institution, the UK Open University has now webcast two live and on-line degree ceremonies. Most higher education establishments routinely videotape degree presentations and many now broadcast these videos as ways of including remote family and friends who could not attend the physical event. In contrast, the UKOU has presented live ceremonies at which the graduands themselves, plus guests, family and friends were all remote and online! The first worldwide virtual degree ceremony took place at 15:00 GMT/UT on March 31st 2000. This ceremony was the first in the Open University's calendar for 2000, and therefore the first formal ceremony of this leading open learning institution in the new millennium. The second online ceremony took place on 18th April 2001, and further ceremonies are planned as part of the routine of open learning.

Online Graduation

Many higher education institutions now offer students online events associated with different aspects of their learning experience with most focused on giving physically present students access to replays of lectures and seminars. Some of these events are also made available live to enfranchise remote and distance learning students. For such institutions the webcasting of degree ceremonies is merely the logical extension of the videotaping of these events. The webcast gives an electronic broadcast of the video copy of the event which is particularly useful for capturing "headline" events such as the installation of a new Chancellor (eg. Leeds University, 2000) or the award of an honorary degree to a prominent celebrity (eg. University of Washington, 2000). Some institutions are even webcasting routine ceremonies to reach out to the remote community of family and friends of graduands who are unable to attend (see eg. Florida State University, 2001).

The Open University of the United Kingdom is one of the best-known international mega-universities (Daniel, 1995). It has significantly over 200,000 students currently studying with it, and has seen over 2 million students through its virtual doors since it opened in 1969. All its students are remote, learners at a distance, and an increasing proportion are also now online. Whilst most of its student body are located in the United Kingdom or Northern Europe, and therefore able to attend one of the dozen or so physical ceremonies to shake hands with their fellow learners and staff, an increasing proportion are international. Indeed for distance students there may be many reasons why they cannot get to a physical venue to celebrate the award of a degree! The Virtual Degree Ceremony project (VDC) is exploring the use of telepresence to reach out to online students who have completed their studies and wish to take part in a ceremonial event to mark this completion. Traditionally, students and their guests are invited to a physical degree ceremony at which they don robes and receive certificates. We are exploring how online technologies and the events themselves can change to suit a new type of remote learner.

So, in 2000 we selected one course with a small cohort of students to act as an experiment in the use of the web as a presentational venue for a virtual degree ceremony. The first event was the first of the new millennium for the Open University, and aimed at an international body of students who were graduating from our Masters Programme in Open and Distance Education (henceforth MA in ODE).

Whilst this ceremony was targeted at a relatively small body of students from a single cohort of students (the 2000 graduating cohort was only 26) because they were from as far afield as Taiwan, the US, Iceland and Hong Kong, this was felt to be a most appropriate vehicle for their graduation. A web based ceremony was also clearly a most suitable venue for the presentation of an honorary degree to Tim Berners-Lee (of W3C.org). The Vice Chancellor, Sir John Daniel, presided in the Berrill lecture theatre of the Open University campus in Milton Keynes, but Dr Berners-Lee spoke from his workplace in Boston and the students themselves were out somewhere in the world. The second online ceremony took place on 18th April 2001 to the next year of the same cohort (this time with a slightly larger cohort of 36). We expect that the third and future ceremonies scheduled for 2002 will be thrown open to all OU graduands who wishes to attend virtually.

As with the first, the second worldwide virtual degree ceremony (webcast live April 2001) included chat, slides and animations as well as audio and video from the Open University Berrill Lecture Theatre in Milton Keynes in the United Kingdom. However, this time, apart from staff on stage, the auditorium itself was **entirely empty** during the presentation - as all the audience were remote! In addition to the UK based participants, students attended from as far away as New Zealand, Brazil, Denmark and the USA. Our ideas to support the 2001 ceremony included using a student-generated yearbook, and phone-in audio notes to add a personalized flavour to the proceedings. One audio note was selected to be used for each contributing student during the appropriate part of the event. A limited number of virtual tickets were issued to faculty and invited guests in both ceremonies. All students received a multimedia CD containing the ceremony and yearbook along with the appropriate certification.

How did we do it?

In the discussion that follows we will be considering the 2001 ceremony, except where explicitly noted. The first experimental webcast in 2000 was very similar in design and execution save that the systems were maintained and supported by hand. The main goal of the 2001 event was to automate these systems, (see Open University, VDC 2001)

The yearbook

The VDC support website was executed using Allaire ColdFusion™ running under Microsoft Windows NT™. The student database was uploaded to the server and accounts are generated for all users. Student accounts were based on their unique student ID and all security and authentication was handled automatically via email. Eg. A student could change their password via the website form, but if they forgot it, they could ask for it to be reissued and have the new password sent to their mail address.

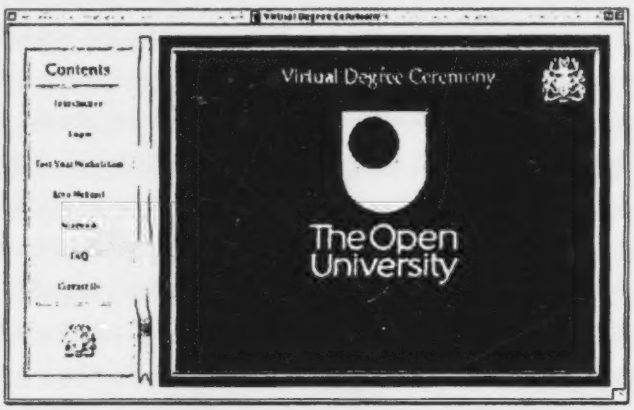

Figure 1. The VDC on-line Yearbook front page.

Some 29 students graduating from the MA ODE cohort supplied thoughtful and extensive yearbook entries, and reported that they found the form interface easy and intuitive to use. Some of the students clearly came

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back to their entry over a large number of sessions to refine and present it. Most of those students who added yearbook entries also uploaded a photograph of themselves and made use of the voicemail server, below. (see Open University, Yearbook, 2001).

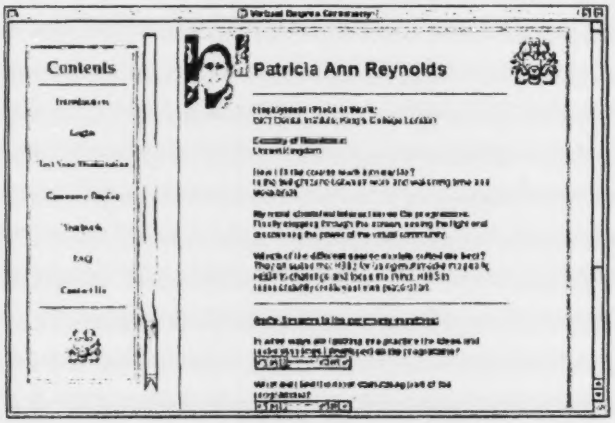

Figure 2. A 2001 VDC student yearbook page

The audio note server

The voicemail service was based on a server originally designed to support the KMi Planet news server (Scott and Domingue, 1997). The audio note server was designed and prototyped using Cypress PhonePro™ running on an Apple Macintosh™ which supports the arbitary scripting of support applications via AppleScript™. This system, whilst far from 100% robust, proved to be very flexible for the prototyping of this innovative application.

Essentially the audio server allows the user to phone in to a computer based account and save/review a number of audio messages, which are then converted into a suitable web-streaming format and uploaded to the web-server. In the VDC case students were invited to answer up to six different questions regarding their degree programme – the sorts of questions, in fact, that they might be asked as they were receiving their award during the ceremony itself. Eg. "Was your study relevant to your work?" and "What was the highlight of your study programme?" etc.

In the ceremony itself, one of these questions was asked live, and answered by replaying one of the pre-recorded segments from the website. In the 2001 ceremony the script itself for this careful choreography of question and answer was generated automatically by the server tools. The server program selected at random from the questions, which the student had chosen to answer in their yearbook – although the ceremony editor reserved the right to review these replies before replay in the live event!

The webcast

Both webcasts (2000 and 2001) were presented as streaming multimedia events supported by KMi Stadium technologies, (Scott et al, 1998). The KMi Stadium technologies have been used for many live events since 1995 and allow us to flexibly integrate multimedia into live presentations and explore the use of different elements of telepresence in different social contexts (see Open University, KMi Stadium, 2001).

The VDC events were presented in a webpage, using a Macromedia Shockwave™ shell to organize the multimedia elements. The backend systems relied upon the Macromedia Multiuser Server™ technologies to bring all the remote users in synch with the presenter clients. In 2000 we allowed users to select the AV streaming technologies they wished to use from Real™, Apple QuickTime™ or Microsoft MediaPlayer™. In 2001 we settled upon Apple QuickTime™ as the single choice streaming media solution integrated into the plugin client. Users had a choice of video data rates suited to their network from audio only (at 33Kbps) to a high bandwidth stream at about (80Kbps). Most users were dial up

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through an ISP supporting 56Kbps modems and so connected to a 40Kbps stream, (with a safety margin and 8 second buffer).

A number of users reported significant technical problems related to access to the AV and Shockwave™ elements via their ISP or firewall. Most users who came sufficiently early to the event to test against our test application reported a satisfactory experience.

In figure 3 we see a view of the webcast page with the student certificate animating in the right hand side. The certificates were rendered as Macromedia Flash™ replayed in the Macromedia Director™ webcast plug-in to zoom in when the student's name was read out and the appropriate signatures animated "writing" onto the certificate. In this case the image and student answer to the question have been drawn from the yearbook page shown in figure 2.

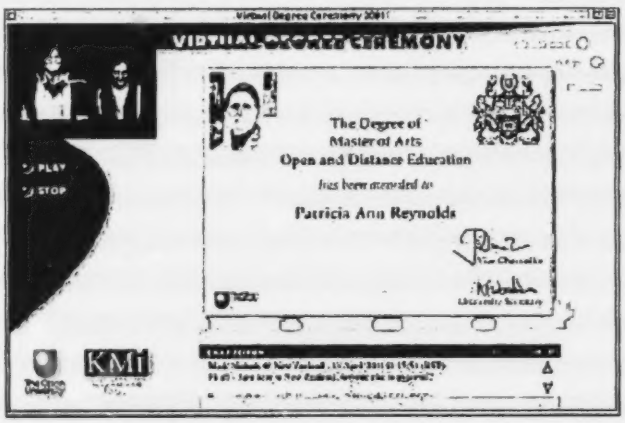

Figure 3. A view of the webcast page.

The video segment is shown in the top left of this screenshot and the student chat room is shown minimised at the bottom of the screen. The chat room was draggable and could be made transparent to reveal the animation below, or as in this case, dragged below, to be out of the way.

Feedback on the 2001 event

Student (and staff) feedback on both events in both years was very positive despite inevitable technical hitches and setbacks. In the 2000 event one student noted that she was joined in the virtual ceremony by both her son and husband, and that all three of them were on different continents at the time. In the 2001 ceremony, students reported that they graduated at home whilst baby-sitting, in the office with colleagues and a glass of champagne, and even with a cappuccino in a local cyber-cafe. A student in New Zealand joked that it was so early/late that he was graduating in his pyjamas! One graduate, a lecturer at the King's College London Dental Institute, even invited her students to join her in the physical celebration of the virtual ceremony during an impromptu lecture!

As with all such events, the users were carefully tracked. Figure 4 shows the basic "ping" data from the Shockwave™ webcasting client. At peak there were some 33 total clients connected, of which 5 were "crew" (ie presenter and facilitator clients); 4 were on the OU intranet (ie. outside of crew clients and the Knowledge Media Institute); 24 were external to the Open University. Whilst these are small numbers compared to many of the live events supported by our technologies they nevertheless represent an interesting client base. The load was carefully managed by server side tools to ensure that it did not exceed the bandwidth limitations of various critical network segments. Guest ticket allocation was handled dynamically so that guest accesses did not threaten the critical graduand services and yet were maximized. Although amusingly, one student from Bogota in Columbia found a critical bug in our software and was able to invite a very large number of family and friends – who, (fortunately for our network) were unable to attend. Further protection was added to the graduand / guest divide by ensuring that critical graduand services were separated on the servers from less critical guest ones!

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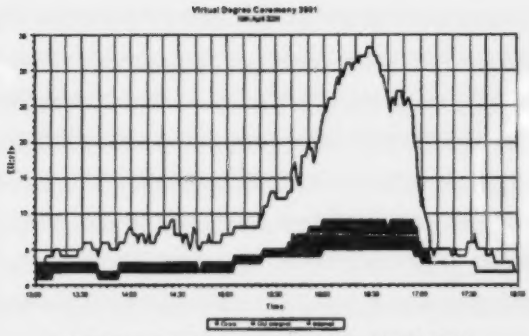

Figure 4. Tracking user load for VDC-2001

In their feedback some users felt that we had adhered too closely to the "traditional" hall and gowns model of the ceremony instead of taking the opportunity to define a new format.

> "The event was fine, I think you might just rethink the use of the hall - is it really necessary to ape the traditional or could they have a more direct tele address in the formal gowns without it being on a stage? I realize that this is partly related to due ceremony but ...." (Male, UK, took part in Office)

Others felt that we were insufficiently innovative with our use of chat facilities.

> "Thought it was a really good ceremony - and it was nice to be able to finish off our virtual course in a virtual way It was also good to *see* old friends again - although like I said earlier it would have been nice to have had a bit longer to chat both before and after the event - which would have allowed for less rush and catch up time when systems failed etc" (Female, UK, took part in Office)

Most students reported attending the ceremony with more than 2 other people physically present with them. And many respondents took the opportunity to make use of good connections in their workplace (plus the indulgence of interested co-workers and superiors) to attend the ceremony from their office.

> "We had a small group celebration with the webcast projected onto a screen". (Female, UK, took part in Office)

And all students, who used the voice server, reported that this was a very useful technology that added significantly to the event.

> "A bit surreal at first, but then I enjoyed listening to other peoples responses. It was great to put a voice to a name at last". (Female, UK, took part in Office)

> You can't believe but I could feel strong emotions! ... I think is important maintain this service to students. Althought it is difficult for me, I liked to record my messages. (Female, Brazil, took part at Home)

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Conclusions

Whilst the format of the ceremony and the support technologies that make it effective raise many technical issues, none of these are seriously challenging. The technologies are relatively robust and flexible and progress in networking standards and quality of student equipment and access makes this easier with each passing day. Plus, students seem to find services based upon them to be very compelling. As with all innovative technologies, what is more challenging is finding the new social context that makes the event make real sense to the new audience and getting the management of the systems to work effectively!

On the management side, the full transfer of these tools and technologies from the research and development laboratory into the University administration services is clearly the next challenge. Whilst much of the 2000 ceremony was supported by hand coding and expert assistance, the 2001 ceremony was largely web-form driven and automatic. The next step will be to fully automate the procedure and make all of the critical steps a manageable (and cost effective) clerical exercise.

However, as noted by our own students, we have inevitably started with this project by aping the forms and conventions of the "traditional" format. The absurdity of a huge auditorium, completely empty of audience but with a traditional gowned procession moving in a stately fashion up onto a large stage certainly raised many smiles! But it also raises the serious issue of finding new formats for more conventional eLearning events.

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Design and Implementation of the Web-based Simulation Tool for 'Digital Circuit Design'

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Web-based learning has the characteristic that the study is done under the learners' self-control. If enough conversation, interaction so to speak, is not provided between the contents and the learners, the learners cannot judge the correct understanding because they study only one-sidedly. In order to solve this problem we are going to design and implement the web-based simulation tool to let the learners design on their own digital circuits using simulation-type contents that have the strongest interaction factors among various types of contents of web-based learning. We can increase the learning achievement of the learners' learning by providing the environment where the learners and the learning contents can communicate in both directions and giving feedbacks of the learners' study results about the complicated digital circuits.

ESL/EFL Websites: What Should the Teachers and Students Be Prepared to Find On the Internet

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There is an abundance of Websites focused on specific areas of interest on the Internet. However, users find it difficult to locate, evaluate and effectively use these sources of information. In this paper we present our findings on the design, structure and content of the most popular ESL/EFL Websites and offer some interpretation of the results in order to help teachers and students of English to profit by using distributed educational resources.

Introduction

Our search for information today starts with the computer that is connected to the Internet, rather that from a library catalogue. The main goal of this search is to find a website/websites that contain the necessary information. We analyzed a number of websites devoted to the ESL/EFL (English as a Second/Foreign Language) issues to understand what is currently available on the Web.

A Website is an information resource and/or an informational interface providing, like a switchboard, connection to other Websites with their own informational resources. Websites actually offer two major types of information: their own resources developed by the given Website creators, and links to the related Websites. Regarding the educational resources, they may offer online distance courses for teachers or/and learners and/or supporting materials that contain texts, activities, tests, etc. The learning courses are either mediated by Website instructors who facilitate the learning and offer feedback, or are intended only for self-learning.

According to the principle of completeness or self-sufficiency that we described in [Serdiukov 2001], Websites can be of three types: liaison, supportive and comprehensive. Each subsequent type enters as a component into the preceding. Thus, liaison sites offer nothing but links, being devoid of its own materials. However, these links are organized around some topic and may be structured by some criteria, e.g. a popular TESL/TEFL/TESOL/ESL/EFL/ESOL Links site. Supportive sites offer a set of materials developed or collected by the Website creator that can be helpful for individual learners and, maybe, teachers, e.g. Dave's ESL Cafe. These Websites also provide links to related sites. However, only the last Website type that embraces various resources and learning courses can be considered a comprehensive site.

Regretfully, learners and teachers do not fully utilize the potential of Web-based resources because the search is currently quite overwhelming and time-consuming, and the Websites are not often optimally designed and organized. There has been little scholarly discussion so far in the field of ESL regarding design, structure, content and quality of the Websites used to teach the English language. We need to rationalize Internet navigation through developing new search engines and, at the same time, to effectively structure and present the online resources and Websites themselves. It is clear that the outcomes of Internet teaching/learning resources' use and online education in general to a great extent depend on the efficiency of their search and selection, on the one hand, and on the relevancy and structure of informational resources that should be available in a "well-organized form" (Romiszovski 1997), on the other. We believe our findings can help learners and teachers as well as Websites developers and providers in using and designing Websites.

Taxonomy of websites

We analyzed the websites asking a question: What do we look for in the ESL/EFL websites? All our requests can be boiled down to five major topics:

1. **Information**: news, ideas, tips, leads, etc.: jobs, conferences, ESL/EFL programs, links to schools and colleges, professional organizations and online publications and databases
2. **Materials**: teachers - to support teaching (lesson plans, texts, activities, tests, etc.), students - to support learning (texts, tasks, activities, tests, etc.)
3. **Communication**: maintaining contact, getting answers to our questions, sharing ideas, practicing in communication and language skills: chat, BBs, discussion fora, listservs, penpals and email.
4. **Publishing**: downloading and printing out somebody's materials, uploading one's works on/through the web
5. **Learning**: online courses with or without instructor's facilitation (on- and off-line)

Methodology and Analysis

We analyzed the first 100 ESL/EFL Websites in each of the 11 most popular search engines: Netscape, Alta Vista, Ask Jeeves, Excite, GoTo, Hotboot, LookSmart, Lycos, Google, Yahoo and Infoseek/Go.com and chose 21 of them that could be found in the majority of these search sites. To this list we added our recently developed DEEEP Website developed for the Distance Education ESL Endorsement Program at the University of Utah in which we tried to incorporate many of the advantages that Web-based education offers at the present (Crow et al. 2000).

These Websites are presented in Table 1 which shows the rank of each site in every search engine list. This table also gives the number of Web pages found (if it is shown on the search site) and the date of the last update (according to Alta Vista). (Note: the Website ranking is constantly changing due to the Internet's volatile character, some Websites may disappear, so these data were current as of March 30, 2001.)

The rank of the site in the search engine list is dependent on how often the site has been approached. However, this information is deceptive: thus, one of the most popular sites is ESL/EFL Educational Resources (according to our data, it was the No.1 site in AskJeeves, Hotbot and Lycos). Actually, it is a purely liaison site with a limited list of links: out of just 9 links it lists, 5 are dead, one is moved to another location, one is dated as of 1995, and only two are current. We understand the rank of the site in a certain search engine list reflects not so much its content or usefulness as the peculiarity of the search engine that accepts the search requests by key words, so the most generic name of the site will attract the most hits. Isn't ESL/EFL Educational Resource something we would type first when looking for specific materials? This is why at the top of the list you will find such sites as TESL/TEFL/TESOL/ESL/EFL/ESOL Links, ESL/EFL Educational Resources, ESL/EFL Resources, Activities for ESL/EFL, and ESL Online, while John's ESL/EFL Resources, Planet English, the English Zone, Peak English, Global English and others that include some differentiating word are often located somewhere at the bottom of the list. Probably only Dave's ESL Café can be considered unique in this category, due to its long-standing popularity grounded on its interesting and useful content, easy navigability and constant updating work by its creator Dave Sperling.

We found out that only some search engines give a short description of the Website, and very few give some ranking - see AskJeeves, for example. Alta Vista is the only engine that consistently gives the update - this information is very important as it shows if the site is current. Absence of this information means that the search would be ineffective as you cannot get an idea which of the Websites is worth looking at. For instance, there is an outstanding SUNY Gopher site that has not been undated since 1996.

We analyzed these 22 Websites by the criteria we developed on the basis of the objectives described above in the process of our research. In all we included 99 characteristics in 18 categories. A detailed list of Website characteristics will be presented at the Conference.

Search Engine / Web site	Last updated	Netscape 82 Websites	Alta Vista 991,574 Web pages	Ask Jeeves	Excite 65,610	GoTo	Hotbot	LookSmart 1034	Lycos 5,920	Google 53,300	Yahoo! 7 categ. and 198 sites	Infoseek (Go.com) 76,822,023
1. TESL/TEFL/TESOL/ESL/...Links	11/00	-	1	11	1	1	16	37	7	1	1	3
2. Dave's ESL Café	11/00	25	35	3	5	2	9	43		6	2	4
3. Englishtown	01/01											
4. Linguistic Funland	12/00	68	36					79		18		16
5. NETEACH	12/00				79					99		17
6. Global English	12/00										60	21
7. ESL House	-		71						25			
8. Peak English	12/00										59	
9. English Online	-			33								
10. US Department of State	-						41	73				
11. CUNY Gopher	-		89									93
12. ESL/EFL Educational Resources	12/00		15	1		22	1	69	1	51		
13. ESL/EFL Resources	01/00		5		28	7	23			19		67
14. Activities for ESL students	-			15	12		58	41				2
15. John's ESL/EFL Resources	10/00		16		84					13		
16. DEIL/IEI	-											
17. Planet English	09/00					13	29	51		10	62	
18 ESL and EFL games, songs...	-							88			3	20
19. ESL Magazine Online	10/00		50		14	65				44	12	9
20. The English Zone	03/00						41	73				
21. TESOL Online	04/00	34										21
22. DEEEP	04/01											

Table 1. ESL/EFL Websites

We identified the following general characteristics of the Websites: users, audience, content, site attributes, access, training, language and provider. Technical characteristics describe such formal features of Websites as structure and organization, design, navigation, update and search capabilities. Content characteristics embrace the following: types of materials (courses, learner's or teacher's materials, texts, activities, etc.), material evaluation, level of learning and language skills, communication and support/help, as well as links to other relevant sites and information for teachers and learners.

Some recommendations on the development and use of the Websites for ESL/EFL teachers and students based on our findings will be discussed.

Conclusion

Our research of the existing ESL/EFL Websites proved that Internet-based distributed resources for learners and teachers of English have became widespread and abundant. The Websites we analyzed target more teachers than learners, many are intended for both categories of users. The majority of the Websites are accessible for users globally and for free. More sites offer links to other sites rather than their own

authentic materials. The sites are predominantly supportive and liaison, few are comprehensive providing, besides information, courses for learners of English. These courses that are run by commercial organizations are usually protected and require paid subscription.

Site features, such as structure and organization, design and navigation, differ in quality, the dates of the site origination and last update are seldom revealed. The main search tool is the menu while a few Websites also show site maps, provide a local (internal) search function and sometimes connection to a major search engine.

Few ESL/EFL Websites fully utilize the capabilities of the Web to enhance the language learning experience through multimedia and interactivity. Less than half of the Websites provide some form of communication, mostly in the form of email, chat and bulletin board. Little support/help is found for learners (how to learn English effectively), as well as for teachers (methods and techniques of teaching ESL).

As the majority of Websites are designed for random individual users, their structure is determined by the willingness and capability of the designers to cover as many topics and items as possible. The ensuing effect is the overloading of the home page. The overload, naturally, hinders the effectiveness of the search, evaluation and use of the resources. The specialized sites that provide certain services, e.g. accredited training and learner support, are more narrow and focused.

Our findings showed that ESL/EFL Websites are mostly informational resources rather than learning or teaching support. What is disappointing is that quite a few individually developed Websites are not well-organized, designed and supported; their content is of little value. Many sites are not updated or do not give the last update.

Clear information representation on the Website and easy access to the resources facilitate the user's ability to find and process the available information and materials. The degree to which the user/teacher can access and manipulate those resources should be increased through better structuring and organization.

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PROFESSIONAL DEVELOPMENT AND SUPPORT FOR TEACHERS ONLINE: HOW TO MAKE IT CONTINUOUS, COMPREHENSIVE AND EFFICIENT?

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Comprehensive and effective professional development and support (PDS) for school teachers can be obtained through an online system offering instruction, informational resources and professional expertise on a continuous and flexible basis. We present a continuous, multifunctional, in-service Web-based PDS system that is being currently developed within the Distance Education ESL Endorsement Program (DEEEP) for the teachers of English in Utah that could serve as a model for professional development program development.

Online Professional Development

Traditional format of Professional Development (PD) for teachers that requires institution-based, teacher-managed, full-time, face-to-face training sessions and printed information materials (books, journals, etc.) is well behind the demands of the today's education. A comprehensive and effective PD and support (PDS) can be provided through an online PDS system offering an ongoing update in the area, needs-focused and efficient instruction, various informational resources and highly professional expertise on a continuous and flexible basis. We are currently developing such a system within the existing Distance Education ESL Endorsement Program (DEEEP) for the teachers of English as a Second Language (ESL) in Utah that is evolving from a traditional "hands-on", one-time training program with tentative technology use into a continuous, Web-based, multifunctional, in-service PDS system based on contemporary technologies.

DEEEP Program

The DEEEP program was developed in 1998 as a partnership project among the University of Utah and five biggest Utah school districts. The purpose of DEEEP is to prepare teachers of all levels (elementary, middle and high) and school administrators to address the needs of the ESL students in their class. These needs stem from the increasing cultural diversity in Utah, which mirrors the processes going on around the USA that are brought about by intensive immigration from various countries. The program offers a choice of two lines: an ESL Endorsement or/and Master's Degree in either Education or Linguistics. The implementation objectives were to use distance education technology to deliver the program to the sites at local schools, and a collaborative model involving university faculty, school administrators and K-12 teachers in the program design, course development, program management and decision-making.

DEEEP currently offers two PD formats: a three-year program consisting of 8 courses in Education and Linguistics that apply to both the Master's Degrees and Endorsement, and a two-year Endorsement program that consists of five courses: Issues and Research in Multicultural Education, L2 Methodology, Content Based Language Teaching, Minority Languages' Issues in Education, and Materials Development and Practicum Program evaluation conducted in March of 2001 showed that the length of the program was the

major negative factor that forced a big number of students to leave the program and affected the remaining students' attitudes. We strongly believe that a PD program that focuses on the certification cannot exceed one year, and started developing a new 12 month-long program.

As far as technology is concerned, initially the instruction was implemented through satellite course delivery that proved unreliable and ineffective, videos and on-site facilitators. In 2000, a DEEEP PDS is being developed that offers online support for face-to-face workshop-type group training as well as for individual learning. In the long run we intend to offer all the program courses online.

Principles for Building an Online PDS System

Development of the online PDS system was based on the following principles:
- *Accessibility*: The PDS system has to be accessible anytime (24/7) and from anywhere; it has to take into account the level of an individual's professional competency and be able to adapt both to this level and his or her PD and/or teaching needs; it needs to include both extensive free resources and specific training and resources offered for money - however, the price of the online program must be considerably lower than that of a traditional one; finally, it has to be friendly and easily navigable.

- *Flexibility*: The system has to offer a variety of educational resources - from full to mini-courses, and to separate course modules and sections; it should provide PD at demand - at full Master's degree level and/or licensure (e.g., endorsement) and for independent self-learning; the PD process can be either group schedule-based or/and individualized and self-paced.

- *Versatility and Multifunctionality*: Such a PDS system gives access to a variety of educational products in different instructional formats to satisfy any user's demand, and applies all the available technologies that provide the best results; at the same time, preference should be given to a limited set of multifunctional educational tools that do not require high-tech equipment or sophisticated expertise on the part of the users.

- *Self-Sufficiency*: The system must contain all the components needed for the PDS - it should be like a Yahoo! of Professional Development so that any user could receive from it any PD program, resource or support he or she needs and would not need to browse the whole Internet in search of urgently sought information and assistance.

The program should as well be more focused on the real teacher needs, classroom situations and problems, offer more communication with all the parties involved including university instructors and school districts, and provide timely feedback from the instructors and facilitators.

System Structure

This online PDS system is structured in this way: it contains information about the DEEEP Program, the courses for the PD and Endorsement with the syllabi, course outlines and reading materials, teacher resources, news and events section, and a Help Desk. The Teacher Resource Online Library (TROL) is a database that contains the materials for the teachers to use in the classroom: lesson plans, texts, activities, etc. The DEEEP web site will also provide an opportunity for the students' communication and collaborative activities. As continuous methodological support is essential for the practicing teacher who may be faced with a complicated situation in the classroom, we began to develop an automatic expert system TESS (Teachers' Expert and Support System) that would offer advice and practical recommendations. The ultimate goal is to develop a comprehensive online PDS system that can serve local, national and international communities of ESL/EFL teachers on a continuous and efficient basis.

Best Practices of Online Classroom Management

Dallas Baptist University, a liberal arts college in the Dallas/Fort Worth Metroplex with an FTE of 4000, began offering online degree programs in Fall 1998. I am fortunate enough to have been an integral member of the creation of this program for Dallas Baptist University. Starting in January 1998, as we prepared for our ten-year accreditation visit from the Southern Association of Colleges and Schools, it was suggested that we formulate our program proposal for distance education to be reviewed by the accrediting committee. With research compiled as quickly as possible, we submitted examples of program proposals, course guidelines, and instructor contracts. In April 1998, DBU entertained the Southern Association of Colleges and Schools review committee *(1866 Southern Lane, Decatur, Georgia 30033-4097; telephone 404- 679-4501)*, and received outstanding affirmation on the impending distance education program. Having received this blessing, we went to work. We created our first course in Fall 1998 and enrolled eleven students. The course was created in MS Frontpage 98 and hosted on an outside server with only a java password protecting the home page to the course. This was the pilot course, and we were already preparing three more courses for the next semester, anticipating high student interest.

In the Fall of 2000, enrollment in 31 distinct courses numbered 605, and students were located in 25 different states and two different countries. As the director of this incredible program, I suggest that "web-based instruction has the ability to provide rich learning environments in a global, democratic, and interactive manner" (Khan 1997) with a great prospect of reaching and serving a new student population. Our enrollments have dramatically increased 500% over the last two years and should continue to rise as we add more degree programs and courses. Currently, we offer two undergraduate degrees in Business and two MBA degrees completely online and have plans to add more concentrations, degree plans, and certifications. These will be brought online as soon as possible in order to meet the growing demands for online education. The Spring 2001 semester reached a peak enrollment of 705.

This brief history of the DBU Online Education program demonstrates our pathfinding effort in developing completely asynchronous degree offerings over the Internet, but what does it involve? Each instructor is trained by the program coordinator for six months prior to developing a course and teaching online. It is this required training process that yields the following recommendations for online classroom management.

What are the best methods for superior online classroom management? Certainly, much has been written on the traditional classroom and how best to facilitate and manage students. The first step must begin with more than adequate courseware management software. Because a good "web-based classroom is not simply a mechanism for distributing information to students; it also performs tasks related to communication, student assessment, and class management" (McCormack 1998), the course management system must effectively offer student-to-student interaction as well as faculty-to-student interaction. Next, the course design must be strong and fluent. Instructors must "be encouraged to reconceive their roles to become designers of learning experiences, process, and environments" (Katz 1999) and not just disseminators of information. Educational goals (McCormack 1998) for the course by identifying the course objectives and prioritizing their significance in the course remembering that the technology used in the virtual classroom should not be in the forefront but rather in the background of the instructional model. In designing the online course, these questions should be asked:

- How much of the course content is based on memorizable facts or a core body of information?
- How much of the course content should rely on activities, such as practicing skills, observing a task, demonstrating a correct procedure, and applying information learned in the course?
- Should learners work alone or in groups to gather information and complete activities?
- When are group activities (e.g., discussions, presentations, collaborations) used within the course?
- When are individual activities (e.g., reading, completing a simulation) used within the course?
- Are different lessons structured for different types of course activities?
- What is the primary method of instructing learners in this course?

(Porter 1997)

The course textbook should be examined for relevance and should offer the instructor enhanced teaching resources such as a CD-ROM, test bank, PowerPoint slides, and even web sites for both the instructor and the student. Many publishers, such as Prentice Hall and Irwin-McGraw Hill, offer college textbooks with multiple resources for the instructor and student free-of-charge should the instructor adopt the text. Instructors are sometimes reticent in adopting a new textbook but, when offered the new resources such as test banks and CD-ROM support, they usually concur realizing it could lessen the workload. This should be decided early enough in the process for the instructor to become familiar with the contents of the textbook.

In addition to good course design, the course syllabus must be carefully constructed as well. The course syllabus "establishes the course guidelines and is the basis for a successful learning experience" (White 2000). It clearly must represent the contract between the instructor and the student, now more than ever. In this contract, all due dates and expectations should clearly be defined for the student, and the instructor should never add an assignment that is not already listed on the syllabus and course schedule. All grading methods (portfolio assessment recommended), types of assignments, and even a participation requirement could be listed. The instructor should also list the possible technical problems and solutions that might be experienced or at least refer students to a

telephone number and email address for help. Time management tips and providing timely feedback are additional areas that should be addressed in successful classroom management online. Because "teaching online is unlike any other educational experience and students have to rely on the written word" (White 2000), guidelines for communication should be spelled out as well and can be covered in the orientation or the course syllabus.

A frequently asked questions list (FAQ) compiled as the course is being taught and placed in the resources section of the course is helpful to both the students and the instructor. Not only will the FAQ section aid the student as the course progresses but it can also prevent the instructor from having to answer the same question from multiple inquiries. A good place for feedback is the course itself. The instructor should develop a discussion thread for students to feel safe in posting feedback about the course and even possible suggestions for improvement. If a student does offer feedback, the instructor might try to implement the change and should acknowledge the student. This will empower the student and further the feeling of community.

A critical component to managing the class is the development of the learning community. What is online learning community? Learning community, according to Judith Boettcher and Rita- Marie Conrad--both respected lecturers in distance and online learning--in their Faculty Guide for Moving Teaching and Learning to the Web (1999), "consists of learners who support and assist each other, make decisions synergistically, and communicate with peers on a variety of topics beyond those assigned. Community goes beyond cooperation; it is a self-managing entity." As an online community grows, learners become more self-sufficient and directed, and the time-consuming tasks such as facilitating discussion, ensuring access to lecture and content resources, and providing technical support can be demonstrated by the other members of the learning community. Learners begin to take some responsibility for their own learning. A learning community can provide students with opportunities for critical thinking and understanding of course materials. Also, the degree of flexibility in an online learning community allows for more student interaction with one another and with the instructor. Both the instructor and the students are participants in the learning process. In a traditional classroom, it is very difficult to enlist all of the participants in a rousing discussion. Online, when the discussion is built into the grade earned for the course and occurs in a "safe place," discussion is prolific and profound. Students share skills, knowledge, expertise, ideas, and experiences to reach an academic goal.

To begin building and maintaining a successful online learning community, the instructor must establish the initial framework and goals for the course. This can be accomplished through the contract between the instructor and students. The instructor should spend time getting to know the students the first week. An introductory discussion inviting the participants to introduce themselves and to share something in particular with the group can lead the learning community in the right direction. All participants, with various backgrounds and experience, should actively join in the class discussion. The roles are equally disbursed with some being facilitators, some being encouragers, and some being inquisitors. A good recommendation is for the instructor to set up an assigned facilitator and an assigned summarizer for each topic of discussion. A safe environment for revealing information should be formed; this trust is taken at face value, but it is implicit in an online environment. "It is crucial to build an environment where people can say what they really think and feel" (McMillan). Mutual respect and admiration should be a constant part of the process in each phase of the degree plan when the students risk rejection and misunderstanding. According to Palloff and Pratt, "the lack of face-to-face contact means that the sense of the group in an online learning community can be fragile, especially as it is forming" (1999). Discussions threads can be a place "where students can test assumptions, try out new ideas, and ask difficult questions in the company of other learners who are doing the same" (Baumann 1997). Because of the anonymity in the online classroom, questions and solutions can be prolific and offered in abundance.

In a learning community, "learners turn to each other first for problem resolution and knowledge building before they seek information from the faculty" (Boettcher 1999). It is true that some become more nurturing and there are those who "attempt to keep things moving when the discussion lags" (Pallof 1999). The instructor's role is to make sure that the learning takes place in some format, but greater still is the facilitation of the discussion. "Faculty facilitators who are attuned to the dynamics of online conversation are essential to the process of creating meaningful learning communities" (McMillan). The instructor/facilitator must provide feedback in the discussion even if it is merely a "cheerleading" comment or a redirection or guideline submission. As the moderator of the classroom, "the instructor in an online class is responsible for facilitating and making room for the personal and social aspects of an online community in order for the class to be a successful learning experience" (Palloff 1999). When an instructor takes the time to share his or her own personal experiences, this demonstrates a willingness for openness in the community. By modeling this behavior, the instructor gives permission for the other students to follow his or her own example.

The online environment can be limiting when the communication is mostly text-based. "Without the benefit of voice inflection (emoticons can only go so far), the meaning of one's comments can easily be misunderstood. For example, a comment meant to be sarcastic may be taken as serious and unintentionally offend" (Lawrence 2000). Even in face-to-face situations, sarcasm can be taken the wrong way and lead to sensitivity and hurt feelings. The context of the response must be taken into account. Time delays in a threaded discussion can be frustrating when waiting on a response, especially if misunderstood. When online learning is "done poorly, it can leave students lost and instructors overwhelmed" (Hollands 1999). This would be the worst possible feeling of isolation and disappointment and would not lead to success in learning. One suggestion for communication is to type out the emotion expressed in parentheses (*smile*) or put in emoticons such as :-) for happiness.

Why build community when it takes time and effort? Certainly, it must be focused on the success of the student and the learning. "The development of a learning community in the distance education process involves developing new approaches to education and new skills in it delivery" (Palloff 1999). Simple steps such as a clear and concise syllabus, student introductions, orientations,

interactive activities, collaborative and cooperative activities, and community activities such as the discussion threads are basic guidelines for a successful community. Facilitator involvement is key as well to the process. Student responsibility in the learning act must also occur. Information must be supplied in many forms to allow students with varying learning styles to grasp the basic idea and concept of the online environment. Successful "online learning communities are grown, not built, online learning communities need leaders, and the personal narrative is vital" (Clark 1998) to the formation of the community. If an instructor will adhere to these guidelines, the community will thrive online and yield happy, successful students and lead to a well-designed course.

Two years ago, Alistair Fraser spoke with regard to online learning at a Syllabus workshop hosted by Southern Methodist University and referred to something called "shovelware." Disappointingly, he was speaking of online learning and what we as higher education instructors were doing with the academic content on the web in the virtual classrooms. He said "virtually all of the instructional efforts on the Web are simply the delivery of shovelware" (Fraser 1999). Shovelware, being the reference "to any content shoveled from one communication medium to another with little regard for the appearance, ease of use, or capabilities of the second medium" (Fraser 1999), was all that existed to offer our students online. With the advent of online community and focused interaction, this will no longer be the case. Active and positive learning is taking place without the traditionally required face-to-face interaction, and it is done asynchronously with communication being the primary key to success. With applying these suggestions to thoughtfully design and moderate an online class, the online classroom should thrive and even rival that of the traditional classroom experience.

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Making Online Education a Reality in a Corporate Environment

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Abstract: As organizations transition through new ways of conducting business it becomes increasingly important for the organization to promote the development of its human capital. Building on existing programs, online education can create a reliable and consistent, yet dynamic learning environment. Additionally, with the highest levels of support, online education becomes an idea generating and culture-promoting arena, which can become a key driver in the development of the organization.

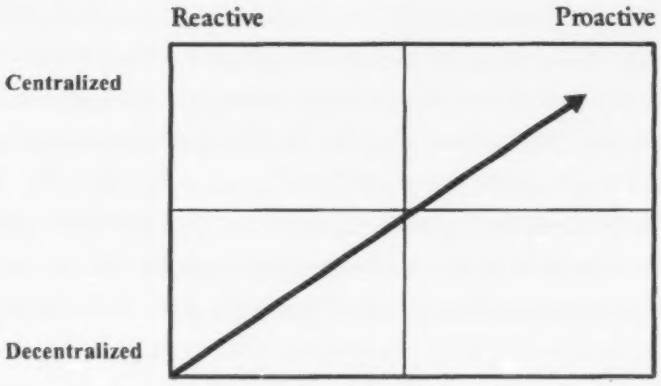
Making Online Education a Reality in a Corporate Environment

The training industry is booming. International Data Corporation is forecasting growth rates in e-learning and training to exceed e-commerce over the next five years. IDC reports that the U.S. corporate e-learning marketplace will expand at a compound annual growth rate of 83 percent. What's spurring this dramatic growth? Technology, bandwidth, management tools, and a plethora of courses that make it feasible for companies to train all of their employees (1).

The emergence of technology in education has allowed online education to become a reality for large, medium, and small sized organizations. Technology now allows organizations of all sizes to reap the rewards of online training through the development of a well-structured e-learning strategy. One of the most common strategies is developing and housing e-learning in a Corporate University. The organization capitalizes on the Corporate University's established goal, sophisticated competency models, shared vision and enhanced learning environment. Through online conferencing, video conferencing, Internet/Intranet, and e-mail, a Corporate University is not just a "brick and mortar" department of education, but a virtual environment for learning.

Online education, through a Corporate University or any other delivery vehicle, can contribute to the growth of an organization. One of the most important contributions is enabling the learning environment to be more proactive than reactive. Although most organizations benefit from training programs, there is still a sense of developing the employees based on some immediate "deficiency of skills." Although training will never be completely proactive, creating a centralized arena for discussions about employee development needs allows for as much proactive planning as possible.

Online Training Environment



Five trends have been uncovered as key drivers for organizations that have moved towards online education (2):

1. Emergence of a Flat, Flexible Organization
2. The Knowledge Economy: From Brawn to Brains
3. The Shorter Shelf Life of Knowledge
4. Lifetime Employability Becomes the Corporate Mantra
5. Corporation Become Educators

BEST COPY AVAILABLE

1. Emergence of a Flat, Flexible Organization

   As organizations re-engineer and restructure in the face of growing competition, hierarchy become flatter. The affect of this reorganization causes individuals at the bottom of the hierarchy who were originally just "doer's" to become more "thinkers" or decision-makers. Combining this affect of decentralized decision making with the need for greater efficiency within a cross-functional work team, environment becomes a primary driver. Organizations search for a reliable and consistent environment that can develop an employee to produce these results.

2. The Knowledge Economy: From Brawn to Brains

   Technology is increasing the intellectual components of jobs. Individuals no longer exhibit certain skills to perform a job effectively, but become proficient in various competencies which enable them to solve a host of problems, creating knowledge capital. The organization must first build these competencies, then use an environment such as an online University setting to map the development of these individuals along predefined competencies.

3. The Shorter Shelf Life of Knowledge

   Due to the fact that knowledge economy requires continuous learning to develop broader skills, organizations are increasing their commitment to learning and education. With technology (Internet) and competition driving a higher rate of change, knowledge has a shorter shelf life. To stay ahead of competition, the online learning environment allows for a sharing of knowledge not achievable by decentralized, reactive training.

4. Lifetime Employability Becomes the Corporate Mantra

   A completely new psychological contract is present between today's employees and employers. Job security is not the issue, rather employees seek to maintain their own portfolio of skills, which is transferable to other organizations. In many instances employers are willing to provide their workers with enhanced employability for increased productivity. This situation in turn places responsibility for learning on the employee and his/her manager. The online University environment subsequently creates structure for the employee in developing his/her portfolio of skills, and maintains an employee's enthusiasm and satisfaction with his/her organization.

5. Corporation Become Educators

   Although decreasing educational standards is increasingly becoming a problem in the U.S., the rate at which technology and competition change the "need to know" knowledge is even more dramatic. Individuals entering the workforce just out of college create a rather large learning curve for organizations. Overcoming this learning curve is a primary task of training. As training becomes more effective and structured, training can develop the employee with little regard to an individual's previous experience. Organizations in a sense become the primary educator, and must look to structure the learning environment as efficiently and effectively as possible.

An online education strategy works to overcome these challenges by creating a network of the organization's entire knowledge capital, and allowing for a self-managed, collaborative, "learning simply to know" environment. Employees not only develop skills to complete their everyday tasks, but build problem solving, creative thinking and leadership skills accessible by the organization at any time.

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(1) Claudia Flowers (2001). Learning Circuits. *Rebuilding E-Learning Companies*. American Society for Training & Development.

(2) Jeanne C. Meister, (1998) *Corporate Universities: Lessons in Building a World Class Workforce*. NY, NY; McGraw-Hill.

The difficulty is in the transition to this new environment. How does it begin, and when will it end? The answer is not as simple as portrayed in a project plan.

The Transition

Incorporating online education into a primarily instructor-led learning environment can best be accomplished by a multi-phased approach. Objectives of each phase should be well identified, and well inside the realm of capability of the organization given its structure and size. This phased approach must place an emphasis on assessment and flexibility. Taking valid assessments of work that has been accomplished along the way will enhance the products the organization is able to deliver in future phases. The results of the assessments may create a need for change along the way, which creates a need for flexibility.

Phase I

The first phase in moving to an online learning environment is to establish a foundation. Set in place the primary steps toward developing the new environment you are looking to create. Organize your resources, decide on your time-line and identify the objectives for your competencies. Introduce high-level group tasks that can begin to define the new learning environment. Don't be surprised to learn that often times communication planning and marketing are just as important tasks at this phase as learning management system development and content design and development. Sell your new environment from day one and get people at all levels of the organization excited about your new product.

Phase II

Define your portal and design and develop your product. You ultimately need to decide where your new environment will thrive. Is it through a Corporate University Intranet, the Internet or CD library. The objective is similar to the marketing of any online product – how can I get the most hits and maintain the products ease of use. You will need to have a system that manages you courseware, whether homegrown on an Intranet, or purchased from a vendor. However, an essential piece to this puzzle is to ensure you have a feedback mechanism built into the learning management system's delivery.

Next, develop your online product using detailed competency models while leveraging existing content. Your first exploration to a this new online education environment is most justly served by transitioning content that already exists for the support of programs that already exist. Remember, you do not know the effectiveness of these programs within your organization, so why look to replace those programs from the start. Develop your products as support tools with detailed feedback mechanisms that will ultimately get you the information you need to know.

Phase III

Evaluate your product. Spend time talking to visitors of your new online learning environment. Collect data from the assessments you've built into your product. Test your users on what they learned. Think about how they would have benefited from a different approach and uncover new ways of delivering content. What you learn will begin to define you path for dealing with the challenges of: Emergence of a Flat, Flexible Organization; The Knowledge Economy: From Brawn to Brains; The Shorter Shelf Life of Knowledge; Lifetime Employability Becoming the Corporate Mantra; The Corporation Becoming The Educators (2).

Phase IV

Revisit phases I-III each time building on the knowledge you have gained. Yes, you will need to redefine your communication plan as the organization changes. There will be new avenues you intend to market to as your online product base grows. Continuously work through these steps and ultimately you will reach a point of sophistication where you are able to exchange instructor-led training for its online counterpart. Before you know it, online education in your corporate environment is a reality.

Presentation Outline

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Status of Corporate Training

- Movement away from the classroom and towards online training
- Estimates of $ toward online training

CCH LIS Experiences/Online Education Strategy

- Available Technology
- Using Flash
- LIS University- design, development, and delivery
- Learn@CT - design, development and delivery

Challenges and Best Practices

- Changing role – toward a Learning Organization
- Technology options
- Learning Management Software limitations

Open Q&A

Design and Implementation of a Portable Web Server Accelerator

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Abstract: In this paper, we describe the design, implementation and performance evaluation of a portable web server accelerator, called Tornader. Tornader resides in front of a web server and improves performance by efficiently delivering cached response. Tornader boosts the throughput of the most widely used Apache web server up to 150% under heavy load. Furthermore, Tornader is easily portable since it is entirely implemented as user-level program with POSIX API.

Introduction

The demand for powerful and economic web server becomes more intense due to recent rapid deployment of web based information system. To increase the capacity of web service without affecting the service environment, we can use a so-called web server accelerator, which resides in front of a web server and acts as a reverse caching proxy, to reduce the overhead of web server(s). We designed and implemented a portable web server accelerator, called Tornader, to evaluate the effectiveness of using accelerator to achieve performance enhancements.

Design and Implementation

Tornader is based on a design called asymmetric multi-thread event-driven (AMTED) architecture that is composed of threads with heterogeneous roles: client thread, server thread, and main thread. Client thread get request from web clients, check if requested object is cached, and send response using cached response. If object is not in cache, it passes client request to server thread. Tornader can have multiple client threads for better performance in multi-processor system. Server thread forwards client request to web server, allocates cache entry, and fills cache using web server response. Client requests are passed back to client thread with the completion of cache fill. If object can't be cached, it forwards server response to the client. Main thread periodically replaces cache entries that are expired, manages time related information, and gathers statistics data. The advantages of using AMTED are low overhead, SMP scalability, and efficient resource sharing.

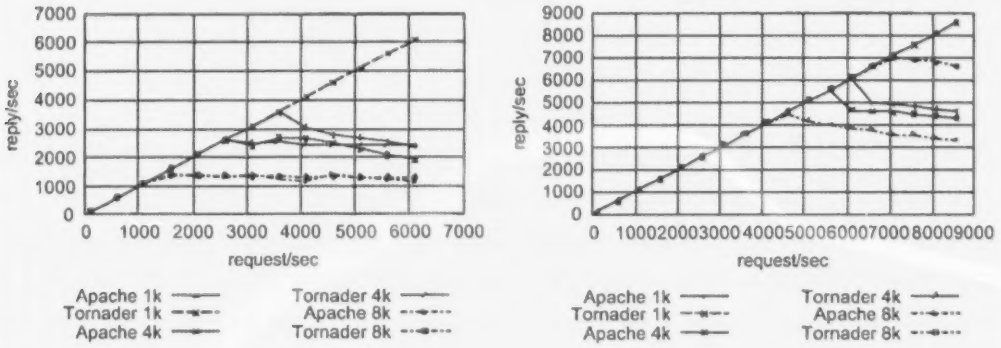
Several optimization techniques are applied to enhance the performance. First, event handling is optimized to group connections with similar characteristics, so that Tornader can void unnecessary polling overhead (Banga 1999). Second, we tried to use as little globally shared resources, so that the synchronization overhead could be lowered. Third, we carefully controlled the use of lock during accesses to globally shared resources. And last, we multiplexed multiple client requests into smaller number of back-end connections to web server, so that the web server can be efficiently utilized.

We implemented Tornader as a user level program only using POSIX APIs, no platform specific features or kernel extensions are used. Tornader can run on any system where pthread is supported.

Benchmark Results

Apache 1.3.20 web server was used for the base line of the performance comparison. One client machine and two server machines are used for the experiment. Server1 is equipped with 1 CPU and Server is equipped with 2 CPU. We used httperf (Mosberger 1998) for workload generation. The workload is a repeated request test for several files, so that the effect of caching in Tornader should be minimized when comparing with Apache. The file sizes are

selected from 1Kbytes to 8Kbytes because these are the most frequently requested size of web objects (Barford 1998). The connection keep-alive feature of HTTP/1.1 is used and there are 10 subsequent requests in single session.



(a) Server1 (b) Server2

Figure 1: Reply rate for Server1 and Server2

(Fig. 1) shows the results for Server1 and Server2 test. The left-hand side graphs plot the Server1 's reply rate against the request rate and the right-hand side plots that of Server2. The performance of Apache degrades when the request rate exceeds a certain threshold because of the increased overhead introduced by a herd of processes (Hu 1999). The performance of Tornader either keeps increasing or increases until stabilization point. In single CPU server, Tornader almost behaves like single-process event-driven server and operates with much less overhead. The additional CPU power of Server2 benefits both Apache and Tornader because their architectures are scalable in multi-processor system. But, the behavior of both servers is almost same as the single CPU case. We can confirm that Tornader still performs scalable in multi-processor system.

Conclusion

This paper presents a portable high-performance web server accelerator, called Tornader. It is based on scalable AMTED architecture and caches web server response for efficient content delivery. We applied several optimization techniques for additional performance gains. Benchmark results show that Tornader boosts the performance of Apache up to 150% in both single CPU and dual CPU cases when the load is high. Tornader also performs scalable in multi-processor environment while Apache does not.

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Establishing Effective Web-Based Distance Education Using Animations, Video and Self-Assessment

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Abstract: Today, the use of the Internet to teach at a distance is growing at a rapid pace. However, much debate concerning its effectiveness still exists. The goal of this paper is to provide a possible framework for achieving effective web-based instruction using animations, video and self-assessment as interactive learning tools. This framework is the result of the authors' work to design and develop a two-tiered educational program in food safety and quality known as The Food Safety & Quality Education Initiative (FS&Q). FS&Q represents a partnership between the University of Arkansas Division of Agriculture, including the Dale Bumpers College of Agricultural, Food and Life Sciences and Tyson Foods to develop a rigorous curriculum that provides both continuing and graduate level courses and programs in food safety via a distance education format. Working with other universities, the University of Arkansas will make available this much needed degree program. The initial goal is to provide curriculum specific to the meat and poultry business, not restricted to Tyson Foods. As we develop the program we plan to broaden the audience to include all food products and processes as well as retail foodservice and grocery.

Theoretical Underpinnings

The learning environment framework presented in this paper was developed according two criteria: established distance education theory and current media analysis. The following is a brief summary of this criteria. In 1990, Moore posed a theory regarding the nature of distance in all educational settings. In 1993, Laurillard offered an analysis of the roles of students and teachers in the learning process, and the strengths and weaknesses of various technological mediums as support mechanisms for those roles. According to Moore (1990, 1996) three different types of interactions are essential to distance education: learner-instructor interactions, learner-content interactions, and learner-learner interactions. McIssac and Gunawardena (1996), who discussed Moore's theory at length, made an important point. They stated that highly structured course content decreases the dialogue between students and instructors, whereas less structured course content increases that dialogue. This statement implies that teachers can help students who are learning at a distance by thoroughly structuring content and supplying avenues that support all of Moore's interaction types. Laurillard (1993) ideas add depth to Moore's theory. Laurillard (1993) provided a media comparison that detailed the strengths and weaknesses of various types of media as support mechanisms for 12 steps of discourse responsibility she claims are essential to effective teaching. These 12 steps describe in more detail what Moore's three types of interactions might actually look like. In addition, Laurillard asserted that academic knowledge is different from other types of knowledge because each subject possesses its own symbolic language. Further, Laurillard stated that learning an academic subject first requires mastery of its symbolic language. In conclusion, although Laurillard did not directly assert it, one may imply that her media analysis can be used to establish levels of interactivity.

The Courseware Framework

The content for each FS & Q course or module was constructed within an interactive textbook or print-based metaphor in a structured manner through: thoughtful articulation of instructional goals and objectives. Further, the FS & Q learning environment uses: 1) animations to: engage students with key concepts, model concepts, and solve

problems, 2) video segments to: provide audio-based explanation, and 3) self-assessment to supply: students with opportunities for reflection and practice.

With regard to the choice to use animations as an instructional method two separate bodies of research and corresponding literature (aside from Laurillard) revealed that the visual representation of information increases a student's ability to learn. The first body of research (which is briefly addressed in this paper) is visual literacy, the second is semiotics. In 1996, Braden detailed Paivio's 1971 Dual Coding Theory of memory and cognition in a discussion on the impact of graphics and illustrations in textbooks. In essence, Dual Coding Theory postulates that humans encode both verbally and visually, and that verbal concepts are hung on nonverbal pegs in memory; i.e., imagery is the effective variable in recall of concrete verbal information. Furthermore, in 1982, Levie and Lentz provided an outstanding review of the research on the effect of illustrated texts on learning by summarizing the results of 155 separate experimental comparisons of learning from illustrated versus non-illustrated text.

> Forty-six of those (155 studies) studies compared learning from illustrated text material versus (learning) from text alone. In all but one of these 46 cases, the group mean for those reading illustrated text was superior to that of the group reading text alone...in 39 of the 46 comparisons, the difference was statistically significant...and the average group score for the illustrated-text group was 36% better than for text-alone groups (Levie & Lentz, 1982, p. 198).

The use of animations within the F S & Q courseware to engage students is obvious. The use of modeling and problem solving needs further explanation. Learning subjects such as engineering and statistics over the Internet is difficult if not impossible. Thus use of animations to teach these subjects may be one of the only ways to ensure successful student outcomes. We propose that animations can be used to actually demonstrate to students how to perform important calculations and thereby solve problems.

In addition, other studies have also shown that video has been successfully used to show dramatic examples and teach procedural knowledge, as well as to provide narrative (Moore 1996). In the FS & Q environment video was used to talk students though the printed material by demonstrating how to work through formulas and equations, perform audits and run statistical software, etc.

Conclusions/Results

In conclusion, the first of the F S & Q continuing education modules will be launched shortly and we will began collecting data to evaluate the success of this framework. The learning environment may be found at: http://www.uark.edu/campus-resources/anscmatr/foodsandq/index.html.

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Data Mining in Collaborative Virtual Environments: An Integrating Framework

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Abstract: Collaborative virtual environments are becoming an intrinsic part of professional practices. In addition to providing communication and collaboration means, they have the potential to collect tremendous amounts of data about collaborative activities. The aim of this research is to utilise this data effectively, extract meaningful insights out of it and employ the new, semantically structured knowledge back in the environment. This paper presents a framework for integrating data mining and knowledge discovery technologies starting from the early design stage of the virtual environment. This KDD[1] framework includes four major groups of components, which begin with the selection of the data that should be recorded and end with a knowledge representation for incorporating dicovered information back into the system and improving the structure of the virtual space and the set of feasible actions that can be performed there. The applicability of the framework has been tested and demonstrated on a real environment.

Introduction

Collaborative virtual environments have the potential to provide professional working environments that can support collaborative projects in different disciplines independent of geography. Consequently, they can provide researchers with enormous amounts of data about various aspects of computer-mediated collaboration. Unfortunately, the design of earlier environments did not pay much attention to the issues of data collection (Greenhalgh, 1999). Thus, the application of data mining methods had to struggle with translating data collected for other purposes, for example, a server log used usually for correct recovery after a failure, into data useful for the goals of data mining. Consequently, the earlier application of data mining methods in collaborative virtual environments has been focussed mainly on the analysis of communication transcripts – whether recorded in synchronous collaborative sessions or over a bulletin board in asynchronous mode (Simoff, 1999; Simoff and Maher, 2000). Apart from identifying participation and collaboration patterns, it has been difficult (if not impossible) to extract and analyse data that can provide insights about structuring the environment and the feasible set of actions. Therefore, we further propose a framework for the design of collaborative virtual environments that support mining of data about collaboration recorded by the environments. This framework differs from the approach of (Chen, 1999), who uses graphical capabilities of the virtual environment to support the visual exploration of external data within the environment itself.

Embedding knowledge discovery in collaborative virtual environments

The framework is oriented towards designing environments that provide the option to collect data for the purpose of its mining and analysis. As a result we have the opportunity to control data collection to a larger extent. There are a number of research efforts in the direction of controlled data collection, carried out mainly in the field of ecommerce and Web data mining (see (Spiliopoulou and Pohle, 2001)). The framework is shown in Figure 1. It includes four major groups of components:

[1] "KDD" here stands for "Knowledge Discovery and Dissemination" – a term introduced by Lucio Soibelman of the Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign.

- "Collaborative virtual environments" is the label for the support related to understanding the domain for which we design the virtual environment, the actual environment design, and its deployment.
- "Data design" groups the issues related to the data manipulation during each of the stages described above. It includes understanding of the nature of the domain data, building a model of the domain that can be expressed in terms of collected data, and the actual data collection.
- "Knowledge discovery" in our case differs slightly from the classical schema (see (Fayyad, Piatetsky-Shapiro et al., 1996)) – the selection and data pre-processing stages are implicitly embedded in the data design, in other words, collected data is expected to be ready for data mining. Another difference is the inclusion of the knowledge representation – among the goals of the data mining is the better understanding of computer-mediated collaboration and the usage of discovered knowledge to improve the structure of the environment. For example, we can provide a template structure of a virtual place, which implies some navigation behaviour. Collecting data about the navigation within the place can provide a source for discovering traversal patterns, which can provide indicators for improving the topology of the virtual place. We need some measure to obtain the necessary indicators for improvement of the structure.
- "Organisational memory": Over the past decade, the CSCW community and related areas have taken a keen interest in organizational memory (OM for short) (Conklin, 1993; Ackerman, 1994; Bannon and Kuutti, 1996; Ackerman and Halverson, 2000). This suggests that there is value in retaining and later drawing on historical records of virtual collaboration. Such records could be referenced when setting out on new virtual collaboration, to "see how others have done it", and perhaps to reuse and re-enact those collaboration instances. Unlike conventional work settings where details of collaboration have to be collected manually through effort-intensive and sometimes intrusive methods, a collaborative virtual environment is an ideal source of data on collaboration, particularly when work is predominantly or entirely carried out virtually, as such an environment can automatically record a great amount of detail on the collaboration.

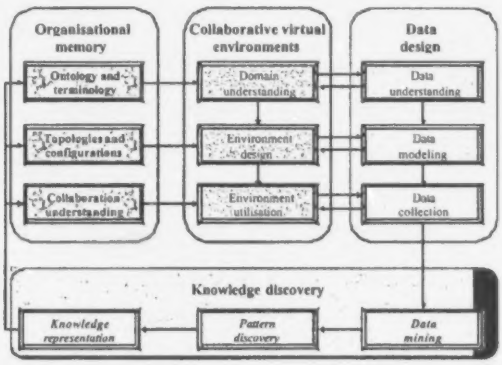

Figure 1: Framework for integrating data mining in the design, application and research in collaborative virtual environments.

Application of the framework

To illustrate the ideas presented above, we show how they were applied to a certain groupware system, LIVENET, whose design is oriented towards data collection. We first introduce the system, then show how knowledge about collaboration was extracted from it.

LiveNet

The LIVENET system is a virtual collaboration system prototype developed at the University of Technology, Sydney (Hawryszkiewycz, 1999). It supports mainly asynchronous collaboration of distributed groups of people, i.e. different-time, different-place interactions, although its design does not limit it from other modes of collaboration. A central server is accessed across the network through one of several client interfaces, most commonly through a Web interface (as shown in Figure 2a). LIVENET provides virtual *workspaces* which bring together people, artefacts (e.g. documents), communication

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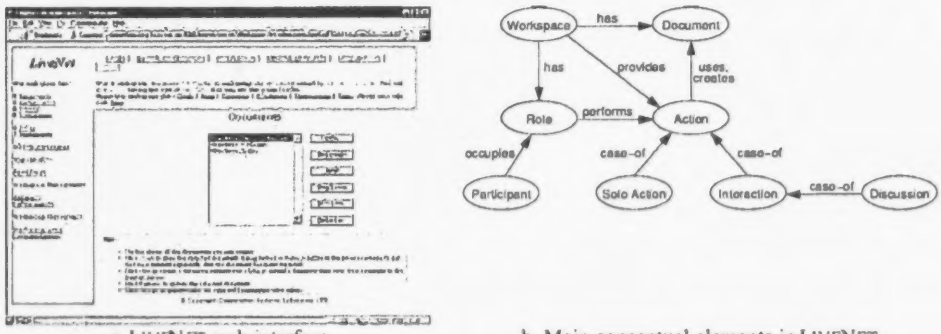
channels, awareness facilities, and a collection of tools, all tied together through aconfigurable governance structure. The relationship of LIVENET's main conceptual elements is represented in the meta-model in Figure 2b (Biuk-Aghai, 2000). In terms of the meta-model, workspaces contain roles, occupied by participants (i.e. actual people), who carry out actions. Some actions may operate on document artefacts, others may be interactions with other workspace participants through discussions. Most workspace elements such as documents, discussions and participants, may be shared between workspaces. Thus workspaces are not just stand-alone entities but nodes in a network of inter-connected collaboration spaces. Neither are structures of workspaces in LIVENET static—once created, a workspace can be dynamically adapted to evolve together with the collaboration carried out in it, while likewise entire "ecologies" of inter-connected workspaces can co-evolve.



a. LIVENET web interface

b. Main conceptual elements in LIVENET

Figure 2. LiveNet collabortive virtual environment

Knowledge discovery in LIVENET

Data about workspaces in LIVENET captures two aspects: a database maintains the current state of all workspace elements (documents, roles, participants, etc.), while log files record all user actions carried out in the system over time. Although the vast majority of users interact with LIVENET through a web interface, the log records captured by the LIVENET server are on a semantically much higher level than those in the corresp onding web access log. While a web log includes IP addresses, document names, timestamps and http request types, the LIVENET log records information in terms of LIVENET's conceptual model. Thus every record includes the name of the workspace and its owner, the name of the participant carrying out the action, his/her role name, the LIVENET server command requested, etc. This allows analysis to exploit metadata available in the application and to capture higher-level actions than a mere web log does (Ansari, Kohavi et al., 2000).

The analysis we carried out focused primarily on the usage log, and to a lesser extent on the workspace database. It involved pre-processing of the log, visualization of workspace data, and actual data mining (we applied the Weka data mining workbench (http://www.cs.waikato.ac.nz/~ml/weka/)). The pre-processing step normalizes session numbers, aggregates lower-level events into higher-level actions, and calculates session summaries. In this context, a session is the sequence of actions carried out by a user from login to logout time. The data used originated from students and instructors of a number of courses at the University of Technology, Sydney, who used the LIVENET system both to coordinate their work, and to set up workspaces as part of their assignments. The data covers a three month period, with a total of 571,319 log records, They were aggregated into 178,488 higher-level actions in a total of 24,628 sessions involving 721 workspaces and 513 users.

Space structuring

Using visualization, certain of the relationships existing within and between workspaces can be discovered. This particularly aids exploratory analysis, when the purpose is to get an understanding of the structure of, and patterns in, the data. We selected data originating from students of one course who used LIVENET during the mentioned period. There were a total of 187 student users, organized into 50 mostly 3-5 person groups, whose use accounted for about 20% of the above-mentioned log data. Initial visualization

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focused on networks of workspaces, to discover how individual student groups partitioned their work in terms of distinct workspaces, and to what extent these workspaces were linked to one another. This exploratory analysis revealed two distinct patterns: the majority of users preferred to use just one workspace to organize all their course work (such as posting drafts of assignment documents, discussing work distribution and problems, etc.). This workspace tended to contain many objects—or have a high *absolute workspace density* (Biuk-Aghai and Hawryszkiewycz, 1999). We term such groups *centralizers*. A few groups tended to partition their work across a collection of connected workspaces, usually with a separate workspace for each major course assignment. These workspaces tended to contain fewer objects (having a lower absolute workspace density) than the ones of the centralizers. We term these groups *partitioners*.

Figure 3 shows a map of LIVENET workspaces with colours highlighting absolute workspace density—green meaning low density, red meaning high density. Branching out from the central node at the top are networks of workspaces for three groups. Nodes represent workspaces, edges represent hierarchical relationships between workspaces. What the map reveals is that the group on the right, Team40, has a very high density in the workspace used for facilitating its work (the workspace Team40_Master). Moreover, it uses only one workspace for this purpose. Thus the right group is a typical example of a *centralizer*. On the other hand, workspaces in the group at the centre have a much lower density. Out of the eight workspaces in this group, six are used for facilitating aspects of the group's work. This is indicative of a *partitioner* group.

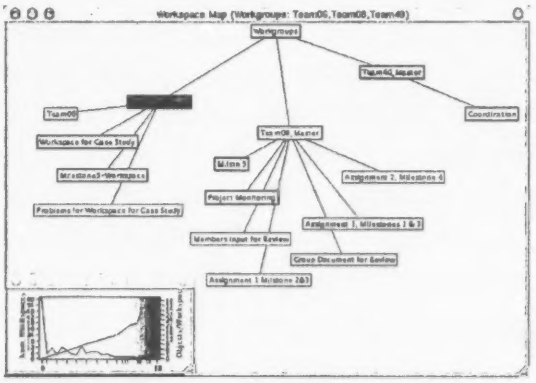

Figure 3. Workspace densities of three different groups

There are plausible explanations for both the centralizer and partitioner cases. Both approaches have their own advantages: in the centralizer case, it is convenience in not having to create multiple workspaces to switch between them, and in addition to have everything available to all participants in a single location. In the partitioner case, the advantage is increased clarity, structuring according to task, and consequently reduced cognitive load in the case of multi-task collaboration. Furthermore, some groups may bring certain preferences as to the way to organize their work into workspaces and enact these preferences in the way they structure their virtual working environment. To recognize such preferences, using KDD methods, and to feed them back into the setup of virtual collaboration environments could thus help offer more adequate support to cooperative groups with diverse working styles.

Feasible actions

A further area we investigated was focused on identifying which actions different groups mainly carried out within LIVENET. All in all, 80 different actions are available in LIVENET. The majority of student groups used only about half of these. The major actions carried out are related to the main LIVENET modeling elements: workspaces, roles, participants, documents, and discussions. A taxonomy of these actions is presented in Figure 4. While all groups had been given the same task—to prepare a number of assignments and to set up a collection of workspaces to support a given process—the way they implemented this task varied markedly. This was evident in a number of aspects of their use of the LIVENET system, such as intensity of use, number of workspaces created, number and length of sessions, number of actions per session, etc. One area of our analysis focused on the proportional distribution of

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main actions. This revealed that strong differences existed among different groups. To illustrate two examples, Figure 5 shows action distributions among the major high-level actions of the taxonomy of Figure 4 for one group whose distribution of actions was fairly even across categories (with the exception of the participant category): the five major action categories did not vary greatly, none of them exceeding 0.29 of the total (circle size signifies proportion out of the total). Figure 6, on the other hand, shows a highly uneven distribution of actions in another group, where one action category (role) strongly dominates with 0.56 of the total, and two other action categories (document and discussion) barely register.

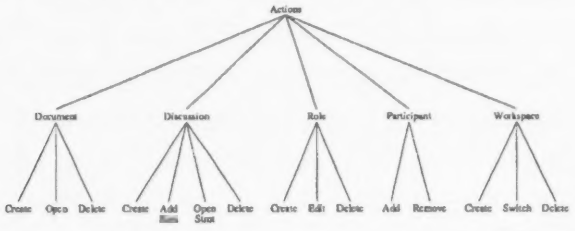

Figure 4. Taxonomy of major high-level LIVENET actions

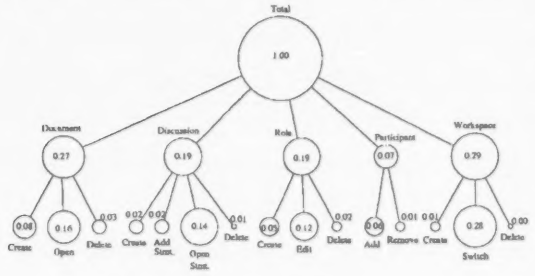

Figure 5. Relatively even distribution of actions in group 1

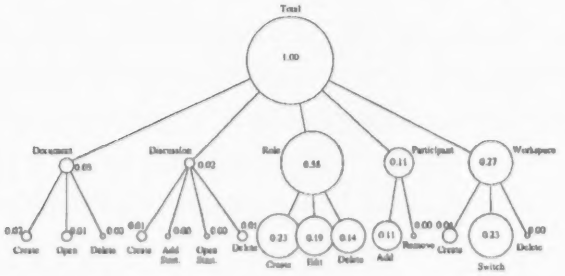

Figure 6. Highly uneven distribution of actions in group 50

This difference may be explained when considering that group 1 (see Figure 5) had a total of 627 sessions consisting of a total of 7446 actions, while group 50 (see Figure 6) had only 36 sessions and 633 actions. Not only did group 1 use LIVENET much more intensively, but they also made much greater use of the system to facilitate their own work (as manifested in the solid proportion of actions in the document and discussion categories). Thus the skew in action distribution towards role-related actions is caused by the under-utilization of other features of LiveNet, not by an absolute high number of actions related to roles (in absolute terms, group 1 carried out 431 role-related actions, while group 50 carried out only 142 such actions). It should be noted that the choice of these two groups for illustration was not coincidental: group 1 was the best-performing group in the course, while group 50 was the worst-performing group, as measured in the marks obtained for their assignments in the course, one of which involved heavy use of LIVENET. The situation was comparable in other similarly scoring groups. Identification of such cases can be of use in evaluating the work of fully virtual teams that never meet face-to-face.

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Conclusions

Earlier observations of human activities in virtual environments uncovered very few aspects of computer-mediated collaboration. The new generation of environments has the potential to produce tremendous amount of data about collaboration. The development of data mining technologies offers a complementary instrumentation capable of extracting semantic information and turning the collected data into invaluable asset. The integration of such environments with data mining technologies provides unique opportunities to unveil some secrets in the art of human collaboration.

The framework presented in the paper looks at the integration of data mining technologies in collaborative virtual environments at the early design stages of the virtual environment. A key issue at the design stage is the selection of the data that should be recorded. Careful design and anlysis of these logs have the potential to lead to improvements of the structure of the virtual space and tuning the set of feasible actions with respect to the purpose of the environment. The applicability of the framework has been tested and demonstrated on a real environment. The framework allows also a feedback from the organisational memory towards modification of the knowledge representation schema, used for representation and incorporation of discovered knowledge. The detailed discussion of the issues related to the modification of the knowledge representation schema, however, are beyond the scope of this paper.

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E-Publishing at Suite101.com: Knowledge Creation and Management

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Abstract: This paper provides an overview of Suite101.com's Net-centric model for publishing, managing, and archiving quality digital content. Many of the activities that helped Suite101.com become a leader in online publishing, such as building easy-to-use Web-based tools and utilizing a distributed work force, are transferable to other industries and professions hoping to further their online endeavors.

E-Publishing at Suite101.com

Started in 1996, Suite101.com was one of the first Web sites to engage real people rather than software to find, review, and publish links to the best content that the Internet has to offer. Today, The Suite101.com Web site hosts 1,000 Contributing Editors and more than 350,000 Members from 100 different counties. Our remote team of Contributing Editors produces over 2,500 original articles a month, adding to our total of over 45,000 published and archived articles.

Suite101.com has become a successful, writer-friendly e-publisher by focusing on two main objectives:

- Creating a user-friendly set of online publishing tools that allow writers to create and publish their online content.
- Developing a Net-centric system of distributed management that enables a community of writes to collaborate and interact independently.

Suite101.com's Online Publishing Tools

During the first 18 months that Suite101.com was online, we worked with a small team of writers to build and perfect a set of user-friendly online publishing tools. Our main objective was to create a set of tools that required no Web design or technical knowledge and were accessible to anyone with an Internet connection. This focus became a distinct competitive advantage, as many of the early e-publishing sites posted their content manually or required content submissions to be in HTML. As a result, Suite101.com was able to market itself to the growing number of new Internet users looking for an easy way to publish their content online.

By removing the need for training or technical expertise, Suite101.com Contributing Editors were able to devote their time to what they lost most – writing. Each Contributing Editor has access to a set of publishing tools that allow them to submit articles, Web site reviews, and engage in reader discussions at their Suite101.com Topic site. All of this is accomplished without any intervention form the Suite101.com head office staff, allowing for the continual posting of new content. Our Contributing Editors can also make use of other content creation utilities such as online polls and bulletins.

The publishing system that Suite101.com created during the first 18 months remains largely unchanged to this day. It represents a collective effort, as the testing and feedback performed by our original Contributing Editors were an integral aspect of its success. This collaboration helped foster an atmosphere of community and interaction between our writers and the Suite101.com staff. It also facilitated Suite101.com's second main objective, which was to create a system of distributed management that utilized the unique qualities of the Internet.

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Suite101.com's Distributed Management System – The Enabling Platform

Today, Suite101.com supports a team of over 1,000 Contributing Editors, each working remotely via the Internet to submit content and manage their unique Suite101.com Topic sites. Despite the size of our team, Suite101.com has been able to manage and expand its remote work force without incurring the costs of a large head office support team. This has been achieved by developing a system of distributed management, which enabled members of our writer community to take on additional levels of responsibility. By utilizing the talents and knowledge of our writers and taking advantage of the interactive capabilities of the Internet, Suite101.com was able to create a work force that has become largely self-maintained.

An example of our emphasis on distributing work to our remote team can be found early in Suite101.com's history. As our team of Contributing Editors grew, our small head office staff found it difficult to review and evaluate the large number of topic application forms that were being submitted. Carol Wallace, our "Virtually Gardening" Contributing Editor, offered to review all of the gardening related applications we received. Motivated by the opportunity for involvement and further participation, several other members of our Contributing Editor team also volunteered to review topic specific applications. We then developed a set of online tools that enabled these volunteers to review application forms and support a team of topic related Editors. Working together, we devised a system that distributed application forms to appropriate Managing Editors for review and approval.

This process served as the first example of distributing a task from the few at our head office to the many on our remote team. Today, this same process has been used to distribute a number of tasks, including copyediting, answering help questions, and mentoring new Editors. We currently have 10 Senior Managing Editors and 70 Managing Editors who support and manage our team of Contributing Editors by utilizing the online management and administration tools that we've created. Full-time head office staff dedicated to overseeing our team is limited to two people, who continually focus on developing new opportunities for our online work force to help manage and oversee our team of writers.

A Net-Centric Model

Many of the activities that helped Suite101.com become a leading e-publisher, such as building easy-to-use Web-based tools and utilizing a distributed work force, are transferable to other industries and professions hoping to further evolve their online endeavors. Our Net-centric business model has attracted interest from a number of companies and organizations hoping to better capitalize on their online presence.

The following provides brief examples of how two industries, Publishing and Education, could benefit from Suite101.com's successful online strategies.

Book Publishing

One of the key strategies that differentiated Suite101.com from other online publishers is our focus on publishing only quality content. Each of our Contributing Editors must pass a thorough review process where Senior and Managing Editors evaluate their writing skill and subject knowledge. Of the approximately 10,000 people who applied to become Contributing Editors over the past 12 months, only 5% were accepted to write for Suite101.com. This process has many similarities to the traditional publishing industry, where editors are asked to review and evaluate thousands of manuscripts. By distributing this work from the few to the many, publishers could greatly expand their capacity to accept and process new manuscripts. They would also be able to harness the intellect and skill of a vast network of editors and writers, a resource that is only attainable through online channels.

Education

Suite101.com's publishing tools and administration capabilities provide an ideal set up for an online classroom. Students could submit their work, collaborate on projects, and engage in study groups by meeting at a virtual classroom. Teachers would be able to access and grade work online and provide lesson plans, notes, and other aids remotely, without being limited to regular classroom hours. Teachers would also be able to enlist help with grading and teaching classes by utilizing a remote team of teacher assistants. Students and teachers alike would not be limited to geographical boundaries, presenting the potential for specialized classes and instruction.

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Applying Suite101.com's Publishing Tools - Working with Barnes & Noble.com

Suite101.com's success recently led to our first contract to apply our e-publishing and online management tools towards an outside project. In June of 2001, we signed a Consulting Services Agreement with Barnes & Noble Digital to locate and hire qualified experts to write unique introductions for a new line of eBooks set to launch in October 2001. The Barnes & Noble.com World Digital Library will feature classics and public domain titles in both eBook and POD (Print-On-Demand) format, and will eventually feature thousands of titles.

We utilized our e-publishing tools and "Enabling Platform" to offer a unique set of services:

- Suite101.com's network of Contributing Editors, Members, and site visitors provide Barnes & Noble.com with access to a talented of pool of writers, academics, and book enthusiasts.
- Introduction writer application forms are processed and evaluated by a remote team of experts, which enabled Suite101.com to process over 1000 applications in the first 30 days.
- Approved introduction writers are able to create, edit, and submit their work using a customized set of online publishing tools.
- Submitted introductions are reviewed and edited by members of our remote team of copyeditors.
- Application forms and finished introductions are archived online and accessible to Barnes & Noble Digital at their convenience.
- Before being compiled into eBook format, digitized titles are checked for scanning errors by a remote team of proofreaders.

As of the date of this paper, Suite101.com has successfully provided Barnes & Noble.com with over 40 unique 1,500-2,000 word introductions. This number is expected to reach over 300 before the end of 2001.

E-Publishing: The Future

Suite101.com will continue to position itself as a leader in e-publishing by continuing to seek outside projects that utilize our experiences and success in publishing quality online content. One of the projects we're currently focused on is providing cost efficient marketing services to booksellers, by offering a database of authoritative book reviews written by subject specific experts. Direct access to a database of expert testimonials would allow booksellers to market and sell the niche books that are well written but struggle to find an audience. We're aiming to locate a partner for this program by the Fall of 2001.

Resource Description at Suite101.com

As a result of its publishing activities, Suite101.com found itself with a large archive of three distinct resource types: articles, recommended URLs, and the pages that unified them – Topic sites. We provided access to these resources using fairly typical Web means: a general keyword-based search engine and a homegrown hierarchy. The larger Suite101.com grew, the more difficult locating information became. Clearly, we needed to adopt a new information management strategy in order to provide access to its resources. For help, we looked to professional information managers – libraries and librarians. It did not take us long to see the benefits of using library-developed methods and tools since these tools are developed for any type of item, from books to electronic data, and for any subject, from Aardvarks to Zythiaceae. Underlying the use of these tools is the principle that makes libraries such successful information managers: good resource description.[1]

Resource description involves analyzing items and creating database records (or index records) to represent their subject and form. The more information added to a record, the more ways visitors can access that information. Because users locate information in three main ways – browsing, searching, or a combination of the two – the resource description needs to include metadata that allows for such functionality. In addition, we considered three

[1]Also known as metadata creation, cataloguing, or indexing.

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issues: first, reinventing the wheel is terribly inefficient and wastes both time and money[2]; second, we expect our collection to grow and need our solution to be infinitely scalable; and third, our visitors do not only seek information on the Web – they search off the Web as well. Accordingly, our solution needed to offer visitors multiple ways to search, be cost-efficient, organize our collection regardless of its size (predictable yet scalable), and provide tools for finding information from other sources (portable).[3]

The Solution

Resource description features two main activities. The first process – subject indexing – involves describing an item's subject. The second process – descriptive indexing – involves describing the non-subject characteristics (metadata) of an item such as the author, the publisher, the date of publication, form, etc. Together, these two processes result in a complete index record. However, before beginning any indexing project, an organization must decide exactly which metadata to record. The Dublin Core (DC) Metadata Initiative[4] defines the metadata required to effectively describe and, ultimately, provide access to Web-based information. While we do not follow the DC exactly, we have used it as a guide for our resource description. Keeping the requirements of the new system in mind as well as the DC metadata set, our solution involved:

- Using an established, scalable classification scheme (hierarchically arranged categories) and an established thesaurus that can be used to search other information repositories for our subject metadata.
- Not only addressing the needs of subject-related queries but also those of other types of queries such as author searching by adding descriptive metadata.

After matching our requirements with the available possibilities, we decided to adopt the Dewey Decimal Classification®[5] scheme (DDC or Dewey) and Library of Congress Subject Headings (LCSH) and to complement these subject-based organization tools with descriptive indexing in order to create a full index record. Because Suite101.com is founded on the participation of people, we decided to hire people to index the resources rather than locate/build semantic analysers.

Subject Indexing

Both Dewey and LCSH describe the subject of an item, but each system arranges the items differently: one arranges them hierarchically by category and the other alphabetically.

Dewey arranges items by discipline so that items that are meant to be used together are found together.[6] Each Dewey number represents a unique subject. The longer the number,[7] the more specific the meaning. For example, 600 represents *applied sciences*, 640 represents *home economics*, 641 represents *food and drink*, and 641.5 represents *cooking*. The notation (Dewey number) allows us to arrange items in order:

600 Applied Sciences
640 Home economics
641 Food and drink
641.5 Cooking

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[2] There are many existing information management tools for use that have had years of fine-tuning. These tools were designed to be scalable for effective use in small to extremely large collections.
[3] To be portable, our tools must be ones that any organization or directory could easily adopt.
[4] More information about the Dublin Core Metadata Initiative may be found at http://purl.org/dc/
[5] Suite101.com utilizes the Dewey Decimal Classification system as the organization structure for the Best-of-the-Web Directory. The Dewey Decimal Classification is © 1996-2000. OCLC Online Computer Library Center, Incorporated. Used with Permission. Dewey, Dewey Decimal Classification, DDC, Forest Press and OCLC are registered trademarks of OCLC Online Computer Library Center, Incorporated. WebDewey is a trademark of OCLC Online Computer Library Center, Incorporated.
[6] This is important because a subject can have more than one place in Dewey depending on its discipline. For example, "herbs" can be found under botany, gardening, cooking, or medicine.
[7] The number 0 does not have meaning in Dewey; it is simply a place-taker.

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Each item in a collection receives a number that represents its main subject. The items are then filed in numerical order so that all the works about cooking appear in the same area, and, within that larger area, are collocated more specifically.

LCSH, on the other hand, represents the subject of an item in natural language form. An LC subject heading is a word or phrase that represents a concept. For example, the heading *Herbs–Therapeutic use* represents the concept of "herbal medicine, botanical medicine, herbal remedies, plant remedies," etc. These headings are applied to items whose subject content matches the concept represented by the heading. The headings are then arranged alphabetically and each one links to a list of all items that feature the heading. Because LCSH tells us which headings to use to represent a concept, we increase the likelihood that items will be found by visitors. In short, rather than use five different ways to express a concept (synonyms), LCSH chooses one and everyone who adopts the system agrees to follow it. A system of cross-referencing leads searchers to appropriate headings. Practically, this means that visitors[8] do not have to guess which words we have used and we do not need to guess which words visitors will use.

At Suite101.com, each Topic site receives three to four subject headings and one to two Dewey numbers assigned by a Cybrarian, as well as freeform keywords assigned by the author. Articles each receive one to three subjected headings assigned by an Indexer and freeform keywords assigned by the Editor. Until recently, each URL received two Dewey numbers, one to four subject headings, and freeform keywords. Now the URLs, like the articles, receive one to three subject headings, assigned by an Indexer.

Descriptive Indexing

Searching requirements do not end with subject searches. To aid visitors, a directory needs to add characteristic (descriptive) metatags to all items so that people can search for authors, publishers, countries of publication, languages of publication, and more. This process is called either *descriptive cataloguing* or *descriptive indexing*.

Each article and Topic site record at Suite101.com receives author and publisher metadata. Initially, we added extensive descriptive metadata to each recommended URL: type, country of publication, author(s), publisher(s), language(s), dates, etc. Part way through the project, we refocused ourselves and the links were no longer considered a primary asset. Our new focus meant that investing so much time and energy in cataloguing the recommended URLs needed consideration. As a result, we ceased recording the descriptive metadata for the recommended URLs.

The Complete Record

Using our metadata, we provide people different options for information retrieval:

- Dewey for people who think in terms of categories.
- LCSH for people that think in terms of alphabetical lists.
- A powerful search engine, for people who prefer searching to browsing, that takes advantage of our subject and descriptive indexing for all levels of searchers, from basic to advanced.

We have also used the metadata as links between related items. Once a visitor finds one relevant item, our directory guides the visitor to related Suite101.com. In addition, we link visitors to library catalogues so they can use the Suite101.com-applied LCSH to search for relevant materials and to other Web directories that use DDC21 so they can quickly locate other recommended Web sites.

Who and How?

After deciding which metadata to use and which schemes to adopt, we began to build the infrastructure and the data entry tools that would allow us to create the metadata. Using the same principles that guided Jason and his team of Editors, we began to recruit people. Because resource description demands a team with very specific skills, we recruited indexers/cataloguers using more traditional means – resumes and references – and pay them a rate/item

[8] This ability to anticipate the subject headings we use is made easier by the fact that many visitors to Suite101.com have some knowledge of LCSH from using their local public library, college library, or university library.

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wage. Despite our traditional recruitment methods, none of the team members actually work in our office -- they are scattered across Canada, from British Columbia to Nova Scotia.

Online tools allow for thesaurus and classification scheme updating, online resource description, in-record messaging, supervision, and querying. All of the Indexers were trained in the online environment using sample records, online help, and probationary periods. Eventually, the team of ten Indexers and Cataloguers consumed much of the Cybrarian's energy, leaving little time to work on other projects. The programmers implemented mid-level permissions, allowing for partial access to administrative functions. This mid-management status was assigned to two team members (Managing Indexer and Managing Cataloguer) who assumed the responsibilities of supporting the Indexers/Cataloguers, training new hires, and correcting the thesaurus. Now, the in-office Cybrarian generates bimonthly pay requests, ensures the Managers are fulfilling their requirements (monthly reports), hires new Indexers, and answers any questions that cannot be handled by the Managers.

While employing real people rather than an automatic semantic analyzer is certainly more time consuming, we can honestly say that each indexed article and each Topic page has been read and analyzed by a Directory Team member. As we switch to our new URL indexing system, each category of recommended Web sites is visited by an Indexer. There is a margin of error with human indexing since people do take different perspectives on issues, but allowing for multiple subject headings and Dewey placements accounts for such differences.

Resource Description: The Future

Suite101.com is committed to ensuring that its resource description policies result in effective information retrieval options. Site usage statistics indicate that our visitors use the search engine as their first search option. This is expected since it is the easiest search method and enjoys the highest profile on the site. The thesaurus, which is only available via Topic sites and article pages, receives almost 2/3 the usage of the search engine. This usage implies that visitors are finding a Topic site or article, via the search engine or an external link and are clicking on the subject headings of a relevant item to locate more information. It will be interesting to see what happens to the thesaurus statistics when the thesaurus is added to the main directory page. By contrast, the Dewey navigational browser has received very low use (1/3 the use of the search engine). We hope that with the proper promotion (linking to other Dewey-organized Web sites) and more exposure to the system, visitors will realise that they do not need to "understand" Dewey in order to navigate through it on the Web. Nevertheless, we are very pleased with the use of our navigational tools and expect statistics to reflect increased use as visitors become more familiar with our site architecture.

Conculsion

Suite101.com will continue to position itself as a leader in e-publishing by continuing to seek outside projects that utilize our experiences and success in publishing, managing, and archiving quality online content. Our experience and expertise in epublishing and information management will prove relevant to a wide range of consumers, from the publishing world to the education environment. From Net-centric distributed management to Web-based peer review to information management, Suite101.com is and will continue to broaden its horizons and seek new, innovative partnerships.

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Immersive Role-Based Environments for Education

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Abstract: The challenge for science educators is to develop educational tools and methods that deliver the principles but at the same time teach the important content material; and to do so in a meaningful way. One research approach is to create experimental virtual role-based environments, and use them to explore the following beliefs:

- educational technology should capitalize on the natural human propensity for role-playing;
- students will be willing to assume roles if the environment makes it easy to do, and if the environment reinforces role-playing through careful crafting of explicit tutorial components;
- that educational software should be engaging, entertaining, attractive, interactive, and flexible: in short, game-like.

This approach, role-based instruction (Slator and Chaput, 1996), allows the student to participate in the practices of a discipline within a naturalistic context. These environments allow the students access to techniques in the context in which they actually work.

Introduction

Over the past several years, the World Wide Web Instructional Committee (WWWIC) at North Dakota State University (NDSU) has progressed through a sequence of developments in the area of web-based, interactive, immersive environments for education and research. These environments began with text-based technologies using goal-driven, learn by doing, game-like techniques for student learning (Slator et al, 1998). Although these techniques were found to be effective, it was believed that further compelling visual enhancements could supplement project goals in cooperation with recent advancements in real-time, desktop graphics accelerators and broadband technologies such as Internet2, DSL, and cable modems, leading to incorporating realistic 3D (3 dimensional) and pseudo-3D graphics.

WWWIC is an ad hoc group of university faculty dedicated to developing internet-based education and research software by fostering cross-disciplinary, collaborative relationships across faculty and institutions. Because of this inclusive policy, the content of WWWIC immersive environment projects range in subject matter across a variety of disciplines such as anthropology, archaeology, cell biology, commerce, computer science, geology, and history.

Teaching Principles

WWWIC has been creating systems to allow learn-by-doing experiences to occur virtually, that is, via a web-based immersive environment. These systems take the form of multi-user environments/games that offer students a role-playing experience in which they to gain a contextualized understanding of the material being presented. The experiences played out by the students are based on a series of goals that students must obtain in order to continue playing the assumed role. Once students enter an immersive environment, they seamlessly enter a virtual world to become scientists: performing experiments, interacting with the world and with each other, and learning how to apply the scientific method in a "authentic" context. These worlds are referred to in various circles as Immersive Virtual Worlds (IVW). An IVW offers the student a characteristic learning environment guided by the 9 principles of WWWIC research (Slator et al., 1999). These principles require that IVW's be game-like, spatially oriented, goal-orientated, immersive, role-based, exploratory, interactive, multi-user, and teach through learn-by-doing techniques.

WWWIC first constructed IVW's as text-based educational environments in an object-oriented multi-user domain server called LambdaMOO (Curtis, 1998). Data from these early environments showed that students could learn and retain certain knowledge more effectively through the use of IVW's than conventional teaching methods (McClean et al., 2001). WWWIC then began a transition process to move its text-based

IVW's toward graphically oriented IVW's as the Internet grew and connection speeds increased. Students are now offered more than just text. Technologies such as Java, Java3D, and VRML 97 (Virtual Reality Modeling Language) now allow students to interact with visualizations of structures, objects and processes of interest that previously they were only able to imagine.

Virtual Cell

From the beginning the goal of the Virtual Cell has been to create an interactive, multi-user, 3D environment in which students are actively engaged with the content and methodology of cell biology in a manner that is consistent with the 9 principles of WWWIC research (White et al., 1999; McClean, et al 2001). To achieve this goal, in 1998 the Virtual Cell development group quickly adopted the VRML 97 standard for 3D model delivery via the Internet. At the time, the best solution for integrating a VRML scene into a Java applet was the CosmoPlayer VRML plug-in (Currently available free for the PC and MacIntosh platforms from Computer Associates at http://www.cai.com/cosmo/).

Being a network-deliverable learning environment, the Virtual Cell allows any user to always have access to the latest version of the software. Importantly, this is an environment in which users from anywhere in the world can occupy the same cell and explore and solve problems together. Students simply need a computer with Netscape 4, a Java 1.1-capable web browser, with the CosmoPlayer plug-in installed.

The Virtual Cell consists of three software elements: 1) a collection of VRML scenes that represent a virtual laboratory, the interior of the cell, and the interior of cellular organelles; 2) a LambdaMOO server and database that contains the textual material (help file and experimental output data) and controls the single and multi-user interactivity; and 3) a Java applet interface. The VRML worlds provide the visual context, while the LambdaMOO server and database and the Java interface controls the interactions. LambdaMOO runs in the background on a network server and manages the activities of the multiple users who simultaneously connect to and interact with the VRML scenes and their associated data.

Using the Netscape 4 web browser, students launch a Java applet, which provides a connection to the MOO server, where cellular processes are simulated and multi-user viewpoints are synchronized. The Java applet also launches an interface to the VRML representation of the Virtual Cell. To the student, the Virtual Cell appears as an enormous navigable space where diagnostic reasoning and visually-based problem solving support the completion of assigned experimental goals.

In September of 2000, the National Science Foundation provided WWWIC with generous funding through an ITR proposal WWWIC had submitted the previous spring. With this added funding WWWIC hired additional programmers to further develop its IVW projects and specifically begin developing a Java3D-based VRML application for distributing its 3D IVW's through multiple browser types across multiple OS's.

One of the most cumbersome obstacles to developing IVW's has been cross-platform/browser/OS delivery of the IVW applications/applets. The Java2 Platform, Standard Edition (J2SE) has emerged as a viable desktop application development environment (Fieldman, 2001). Run time environments are now available for all major computer OS's with the exception of Mac OS, and even that will be made available once OS X is released (http://java.sun.com/j2se/1.3/jre/; Steinberg, 2001).

Another offshoot of the Virtual Cell project is the development of a J2SE/Java3D level editor for the project's IVW. Future versions of the IVW level editor will provide tools so robust that educators not associated with Virtual Cell development will be able to create their own IVW level implementations without having to know either the MOO or Java programming languages. The first release of the IVW level editor will come around the same time as the initial Java3D Virtual Cell release. Knowledge learned from the implementation of this technology will be leveraged for use with all other IVW projects.

Geology Explorer

The Geology Explorer (Saini-Eidukat, Schwert, Slator, 1999; Schwert, Slator, Saini-Eidukat, 1999), is another IVW where students assume a geologist's role on an expedition of exploration to the mythical "Planet Oit." On this fictional planet, students participate in field-oriented expedition planning, sample collection, and "hands-on" scientific problem solving. Similarly to its sister project the Virtual Cell, a LambdaMOO server controls the Geology Explorer's planetary simulations.

The first time a student plays the game, they are assigned a primary goal and a secondary goal. Primary goals, worth 100 points each, are to identify one specific mineral that is somewhere on the planet. Secondary goals, worth 25 points each, are to identify any rock or mineral they find along the way. After being informed of their goals, students are able to roam freely throughout the world. They may head to a store to purchase

instruments, a museum to observe samples of rocks and minerals they may find on the Geology Explorer, or head out into the Oit's many exotic locations. One of the first beings a student is likely to encounter are the software-based tutors.

Tutor intervention is one of the most important components of the Geology Explorer. There are 3 major types of tutors: the Exploration Tutor, the Equipment Tutor, and the Geology Tutor. The Exploration Tutor leads the student to his/her primary goal by informing the student of when he/she has walked past something important. The Equipment Tutor suggests instruments and equipment that the student should purchase so he/she may perform the necessary field experiments that properly identify the student's primary goal. The Geology Tutor is similar to a professional geologist in the field. This tutor comes to the student after he/she has incorrectly guessed the name of a rock or mineral. This tutor then informs the student on several issues such as possible tests that the student has not yet performed, but may help in identification, why the student's guess was incorrect, and how the student's guess is different from the rock or mineral that he/she has observed (Slator, 1999).

Since the original implementation of the Geology Explorer, there have been a number of additions and improvements to the interface and the material presented to the students. There are plans to expand the tutor interface to provide more conversation based tutoring where students can interact with the tutor, asking it specific questions or giving it answers to questions it asks. Since the inception of the text-based world, the Geology Explorer development group has have also created and tested a Java-based graphical client. In building this client, the group has digitized hundreds of photographs of rocks and minerals and created background images for each "room" in the IVW. There are also graphical representations of the Oit planetary map, instruments, and samples that the players have taken. A help interface has been implemented and is constantly being expanded and reformulated into a more efficient tool.

There are also a number of additional modules in development, including an interpretive module and a hydrology module. The interpretive module is being developed for the purpose of teaching students landscape interpretation, the process of discovering what geologic forces fashioned the geological formations of a particular area. There is presently one such module on planet Oit. This module allows students to enter a small geological area and determine the structure of its formations. Using geological principles students must analyze the result of various experiments and observations to develop a hypothesis concerning these formations. Students who correctly interpret the data are able to deduce that the same geological forces that created the dike formation also formed the area's landscape. The hydrology module is the second of the two experimental modules and is in very early development. The intent of this module is to teach students the geological concepts that predict river discharge, a river's power potential, and other more advanced hydrologic concepts.

The Geology Explorer development group is presently analyzing the feasibility of creating a new planetary environment where more advanced geological topics can be presented to students. In building this advanced planetary environment the group hopes to incorporate and dramatically extend the dynamic 3D visualization and construction technologies currently being investigated by Virtual Cell and DANA development groups. WWWIC, and the Geology Explorer development group, considers an enhanced visually stimulating IVW a much more conducive environment for students to discover and explore the simulated role of a geology researcher and there fore provides an superior mode for presenting the practices, experiments and resources of the discipline for teaching purposes.

Digital Archive Network for Anthropology (DANA)

Where most other WWWIC projects are education centered IVW's, DANA is a project that has as much to offer in the form of research benefits to the discipline of anthropology as it does to the education of its students. DANA was originally (and still is) a project of the NDSU Archaeology Technologies Laboratory (ATL). Intended to be an Internet-based network of interoperable databases forming a global **Digital Archive Network for Anthropology** (Clark et al., 2001), the network will link researchers, students, and the general public to realistic, accurate, visual representations of artifacts, fossils, and other archived objects. This federation of databases will differ from other anthropological archives in several ways. Most notably, it will contain 3D models of material objects that are sufficiently precise to allow for a wide range of detailed measurements through the application of specially created "virtual calipers" – 3D measurement tools – developed for use in a J2SE/Java3D environment.

The ATL through the help of the Information Technology Services department at NDSU serves as the administrative hub for DANA. Prototypes of the DANA architecture, critical software (applets, servlets, and virtual tools), database template, and the initial database have been developed. DANA is already a working piece of J2SE/Java3D-based software that is being extended to provide a geographic and materials-based

interface for two preliminary test databases. Institutions involved in the project can use generic SQL statements to create database tables and populate them from spreadsheets. The SQL commands are as generic as possible so they can easily be adapted to any SQL database. Java servlets have been created to handle query traffic for both Oracle and PostgreSQL, and soon servlets will be added for Informix, DB2, mySQL, SQL Server, and others. The use of spreadsheets minimizes the learning curve for data entry, thus encouraging participation in the DANA project.

The primary task of the DANA institutions will be the archiving of anthropological data in textual and visual forms. The set of textual records will be very large, including records stored at the NDSU site and at a number of other sites, and will be accessible via both Internet2 and standard Internet connections. Efforts to organize, navigate, and comprehend large data sets with complex information and high-resolution graphics will work most effectively with the next generation of Internet. The broadband network of Internet2 will provide a smooth and reliable system for comparatively rapid accessing of large data files. For those people without Internet2 access, the database will contain models in at least two levels of compression in order to best accommodate the user's hardware capabilities and bandwidth.

Researchers wishing to use DANA simply open a web browser and point it to the following URL: http://atl.ndsu.edu/archive/dana.htm. Once there the ATL website check the user's computer to see if Java Web Start (JWS) is installed. If it is not the website redirects the user's web browser in a user-friendly manner to the JWS download and installation URL located at "http://java.sun.com/cgi-bin/ javawebstart-platform.sh/". The Java Runtime Environment 1.3 is installed at the same time that Java Web Start installation has been completed. Once the researcher has completed the installation, he/she returns to the original URL. If the researcher has not already done so, he/she must install the Java3D Runtime files for the researcher's OS. Future implementations of DANA through JWS will automatically download and store the appropriate Java3D runtime files for the researcher's OS. This feature is already available in JWS through the jnlp "resources" XML tag (http://java.sun.com/products/javawebstart/jnlp-1_0-spec.pdf). If the Java3D Runtime is already installed, then all the researcher is required to do is click the "Launch DANA Application" button. The second time the researcher launches the DANA application in this manner, JWS will provide the researcher the opportunity to place a shortcut on the his/her desktop so in the future the researcher will not ever again need to launch a browser to use the DANA application.

The DANA development group joined WWWIC once the project was successfully funded through a grant provided by the Northwest Academic Computer Consortium (NWACC). As an attempt to generate projects that conform to the 9 principles of WWWIC research, the DANA development group has begun work on an IVW that draws from the strengths of the DANA network. The DANA-related IVW is known as the Like-a-Fish-Hook Village (LFHV; Smith 1972) project as is being developed as a cultural teaching resource to inform the general public and North Dakota State Museum patrons about the significant impact that the coming of white Americans had upon Native American cultures. The ATL will conduct a 3D digitization project to create 3D models of LFHV archaeological artifacts to be stored on the DANA network, and from which the IVW will draw dynamically draw much of its 3D content. The LFHV project will draw on technical experience garnered from the development of Virtual Cell, Geology Explorer, and DANA.

Data Results

WWWIC has shown that graphical or text-based virtual worlds designed to support authentic instruction in cell biology and geology can significantly improve the student's ability to solve authentic problems associated with those two disciplines. The worlds employ consistent elements across disciplines and, as a consequence, foster the sharing of development plans and development tools. Of particular interest for the experiments described here are two virtual worlds, the Virtual Cell (White et al., 1999) and the Geology Explorer (Schwert et al., 1999). Each is hosted on the Internet and has the capability of multi-user interactions. The common technology is a LambdaMOO server and database (described above) that contains the contextual material (help file and experimental output data) and controls the single and multi-user connectivity and interactivity. For the Virtual Cell (http://vcell.ndsu.edu), LambdaMOO also manages the three-dimensional display of VRML worlds representing a virtual laboratory, the interior of the cell and its organelles. The display of the world and its direct interactivity is managed by a Java applet. The version of the Geology Explorer used in the experiments described here utilized the textual interface features of LambdaMOO. A graphical version of the Geology Explorer is now available (http://oit.cs.ndsu.nodak.edu/).

The basic experimental design for the Virtual Cell and Geology Explorer experiments were nearly identical. Student volunteers were recruited from a large-enrollment introductory-level general science class (General Biology or Physical Geology) with the offer of extra credit points. The Virtual Cell experiment was

performed with two sections taught simultaneously by different instructors, whereas the Geology Explorer experiment was involved a single section. Each student volunteer and non-volunteer completed a pre-treatment scenario-based assessment exercise. These exercises were problem-based questions specific to one of the disciplines. (Visit http://www.ndsu.edu/wwwic/vc/evaluation/eval2.htm for the Virtual Cell scenarios.)

Within each course, the volunteers were assigned randomly to one of two groups based on data from a student-completed survey (http://www.ndsu.edu/wwwic/vc/evaluation/eval1.htm) that characterized their computer literacy, gender, and prior laboratory experience. The Virtual Cell group completed authentic Organelle Identity and Cellular Respiration activities in the virtual world, and the WWW group performed two computer-based World Wide Web exercises that required a similar amount of time with computer-based activities. The Geology Explorer group was assigned a single authentic mineral identification activity, and the corresponding Alternative completed an exercise requiring WWW-based activities. For both experiments, non-volunteers formed the control group and performed no additional educational activities. About one month after the activities were completed and just prior to the end of the semester, students completed post-intervention scenario-based assessments. A total of 334 and 368 students participated in the Virtual Cell and Geology Explorer experiments, respectively. Multiple student graders trained against a standard approach scored the pre- and post-intervention scenario assessments. For both experiments, a score of 100 was indicative of the score a professional in the field would obtain. Because a significant correlation of scores for the Virtual Cell graders was observed, the mean score was used as the experimental observation. A separate goal of the Geology Explorer experiment was to evaluate fourteen assessment scenarios (as opposed to just one used for the Virtual Cell experiment). Because of smaller sample size per scenario, reliable correlations of grader scores within a scenario could not be obtained. Therefore, the scores of each grader were evaluated separately.

TABLE 1
Mean post-intervention scenario scores for 1999 Virtual Cell experiment with NDSU Biology 150 (General Biology) students.

	Module	
Mean	Organelle Identification	Cellular Respiration
Control[a]	17.4a	10.6a
WWW	19.7b	13.7b
VCell	22.7c	17.3c

[a]Treatment population sizes are: Control=145; WWW=94; and Virtual Cell=93.
Within any column, any two means followed by the same letter are not significantly different at P=0.05 using the LSD mean separation test (McClean et al., 2001)

Two-way analyzes of variance (ANOVA) were performed to determine if any significant Virtual Cell treatment effects could be detected. The observation that the means between the two class sections were not significant implies the teaching approaches by the instructors in the two sections did not confound the student scenario assessments scores. The ANOVA also demonstrated the post-intervention mean score of the Virtual Cell group was significantly higher than the corresponding score for the WWW and Control groups (Table 1). This large experiment clearly demonstrates the Virtual Cell experience had a significantly positive effect on the ability of students to solve problems in the mode of a cell biologist. The fact that the Virtual Cell group mean was significantly higher than the WWW group strongly suggests the improved ability was not simply the result of computer-based time-on-task, but rather was directly related to the Virtual Cell experience. In addition, the results demonstrate the WWW group mean scores were significantly higher than those of the control group. Because of several confounding factors, it is more difficult to adequately explain these mean performance differences. This difficulty, though, does not diminish the significant improvement in performance demonstrated by the students who used the Virtual Cell.

For the Geology Explorer experiment, the data was analyzed by Analysis of Covariance to adjust for variation associated with pre-intervention scenario assessment score and variation associated with varying degree of difficulty of the fourteen post-scenario assessments (versus one for the Virtual Cell experiment).

Consistent with the results of the Virtual Cell experiment, the mean post-intervention scores for those students completing Geology Explorer goals were significantly higher than the alternative and control groups (Table 2). Although the means of the three graders varied, the trend of Geology Explorer students performing better on the authentic assessments was consistent. Unlike the Virtual Cell experiment, the control and alternative group mean scores were not significantly different.

TABLE 2
Mean post-intervention scenario scores for 1998 Geology Explorer experiment with NDSU Geology 105 (Physical Geology) students.

	Grader		
Mean	One	Two	Three
Control[a]	25.1a	25.5a	44.5a
Alternative	29.3a	27.0a	42.6a
Geology Explorer	40.5b	35.4b	53.4b

[a]Treatment population sizes are: Control=195; Alternative=95; and Geology Explorer=78. Within any column, any two means followed by the same letter are not significantly different at P=0.05 using the Duncan's multiple range mean separation test (McClean et al., 2001).

Conclusion

For the past several years, WWWIC has continuously developed systems to allow students to explore virtual environments via web-based Immersive Virtual Worlds or IVW's. These worlds provide opportunities for students to assume the roles of scientific researchers in several disciplines such as Cell Biology and Geology. These IVW's take the form of multi-user environments/games so that students may share the role-playing experience with other participants in order to gain a more complete understanding of the material being presented. Interface usability is an important aspect of IVW development. Scenario tests suggest that students who use IVW's are as satisfied with their IVW learning experiences as they are with traditional study methods. However, WWWIC is constantly seeking to improve the IVW user experience. This has lead the WWWIC IVW projects to investigate innovative methods for implementing Java technologies such as J2SE and Java3D. Though the content for each IVW project is relevant to the academic discipline for which it seeks to inform, many of the technological developments pursued by the development group can be leveraged to solve problems encountered by all WWWIC projects. The problems include, but are not limited to cross-browser/platform compatibility and interface usability.

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Knowledge Management Tools from a Systemic Perspective and the Usage among District Medical Officers

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Abstract: How to support knowledge acquisition and sharing at work have become central issues for many organizations. Internet has realized the broad usage of both information and communication tools for learning. What is often missing in the discussion about knowledge-tools is the question about what constitutes the act of knowing and learning. This paper will discuss this from a systemic perspective. Distinctions are made in order to analyze some common types of tools used for Knowledge Management. Results from a case study made at a primary care unit in Stockholm will also be presented. Interviews with district medical officers at the primary care unit are used in order to discuss two types of knowledge-tools; expert locator system and knowledge repository. The results from the case study indicate the need to design knowledge-tools on Internet according to personal preferences.

Knowledge, Learning and Knowledge-tools

Some advocates of Knowledge Management claim that there are different kinds of learning situations; one where knowledge is transferred and one where *new* knowledge is created (Zack, M.H. 1999; Davenport, T., Prusak, L. 1998). The difference they discuss is that the first one can be handled easily through databases while the latter one is a bit more complex and involves creativity among people. If one consider the discussion held by Maturana and Varela, one will realize that the distinction between old and new knowledge is inadequate when it comes to learning (Maturana, H.R., Varela, F.J. 1987). People cannot integrate other people's knowledge and "know" just the same as the "sender" of knowledge. Knowledge must, according to Maturana and Varela, develop into new knowledge inside the internal system of people. While those systems are not alike, few people can have the same conditions of developing the same knowledge. Also, organizations and people are examples of extremely complex systems (Schoderbek, P.P., et al. 1990). A characteristic of these is that they are extremely difficult to understand, for example what triggers them to act in a certain way. What triggers people to learn is dependent on many factors such as our mental models (Espejo, R., et al. 1996; Argyris, C. 1982).

When discussing people and their learning processes, one should be aware that we are dealing with open systems which need interactions with the outside world. The organization and the people in it need, for example, to receive requests, have negotiation sessions and get feedback in order to learn and to develop (Winograd, T., Flores, F. 1987; Winograd, T., et al. 1992). To create and maintain relationships, trust is a critical part according to Kimberly and Bouchikhi (Day, G. S., et al. 2000).

Peter Denning, a professor in the field of systems approach, has defined several levels of knowledge that span from the novice to the master (Denning, P. 1995). The *novice* is the one who knows that there are rules of action in a certain domain but does not know what they are. The characteristic of an *advanced beginner* is that he or she is familiar with common situations and knows the rules to be used. New situations can cause breakdowns. The *professional* on the other hand, is capable of making standard promises to a client and fulfills them to the client's satisfaction. In a new situation he or she is able to work out appropriate actions by application of rules. The *expert* can, beside this, also handle more complex situations and is admired by others because of his or her way of performing. This person seldom thinks in terms of rules and finds it even difficult to explain to others what rules he or she works with. On a higher level we find the *virtuos*, characterized as a source of inspiration to others. Finally, the *master* is the one who has the capacity to innovate and set new standards for action.

We will now discuss different categories of IT-tools and investigate them as knowledge-tools. The levels of knowledge, presented by Peter Denning is applied as an instrument for defining on what level different kinds of IT-tools can be useful. *Knowledge repositories* are database systems that can store process descriptions and so called "best practices", documented rules as well as experiences. When considering that the application of documented rules as well as documented experiences only can create "advanced beginners" or "professionals", the knowledge repositories are not enough for people who want to reach the expert level. Strassmann, who has studied "best practices" states that they are concerned with the simplified picture of work (Strassmann, P. A. 1997). He claims that the descriptions are useful only to newly employed who have not yet experiences of working with a certain type of task. It is also difficult to extract knowledge from an expert since some of the expert's knowledge is hidden. To be able to reach the level of an expert or higher, people need to receive specific advice from others. The questions being handled are much more complex than on the lower levels and should therefore be treated in a much more sophisticated way than what can be defined in documents, for example. So called *Expert locators* can help people find knowledgeable people. These systems aim to stimulate human interaction. Also the usage of *Groupware systems* suits the view of knowledge as something that develops in a social context together with others. Groupware systems help people to develop digital networks of communication and learning.

Knowledge-tools for District Medical Officers

This section will present some results from a case study made at a primary care unit in Stockholm. The purpose of the case study was to investigate and diagnose the learning situation concerning continuos learning. All of the working and learning processes were discussed with the crew of the unit. The interviewees were district medical officers, district nurses, assistant nurses and secretaries. The total amount of interviewees was 24, seven of them were district medical officers. Every interview lasted for one hour and was based on discussions about the interviewees' experiences from continuos learning at work as well as the usage of IT-tools for both working and learning. Only the medical officers had access to the Internet and to a couple of common knowledge-tools. This presentation will therefore be restricted to the experiences of the district medical officers.

To be able to illustrate the usage of knowledge-tools at work, a workflow between a district medical officer and an external specialist is used. The workflow is modeled according to the Action Workflow Approach (Winograd, T., et al. 1992). There are four phases of the loop between the district medical officer and an external specialist; the first is for preparing the request, the second for negotiation, the third for performing and the last for feedback about the performance. In the loop the two common knowledge-tools, i.e. the expert locator system with references to specialists outside the unit and the knowledge repository for advice and treatment programmes, are placed according to their different purposes. The expert locator system is located in the first phase, i.e. when the medical officer needs to know who to request, what specialist is the most suitable at the time. The knowledge repository, on the other hand, is a part of the performance phase in such a way that it is to be used as a documentation of the specialist's knowledge and used instead of a personal discussion. Also, the medical officers had access to the latest discoveries in medicine presented on the Internet.

What was shown in the interviews was a skepticism towards the common expert locator. Some said that they had their own address book for experts. These experts were often people known from previous work places or people who they had been in contact with through different work situations. Concerning the treatment programmes the doctors expressed that they sometimes could learn from these but that they often had to combine reading the documents with calling the experts. Some felt that the treatment programmes were too basic to be useful. One said: "Treatment programmes can be used as some kind of reference book. But our patients are unique, they can have several different diseases at a time." Another comment was: "I need to discuss the treatment of a special problem."

Conclusions

What could be seen in the case study was that the common expert locator was seldom used, many of the district medical officers had their own personal list of experts. Common knowledge repositories face another problem. They try to address a broad audience with different types of problems. The uniqueness of people and their problems is neglected. The possibility to negotiate the request is reduced. Also, while they shall address so many, they tend to be too simplistic. Therefore these can only be used for basic knowledge. To be able to reach higher levels of knowledge, in primary care units or elsewhere, dialogue is needed. For this, sophisticated expert locator systems as well as groupware systems are useful. What can be discussed further is how expert locators can be designed from a bottom-up approach rather than from top-down. How to build in trust must be discussed when these systems are designed.

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Integrating Technology at the University Level for a Change: Early Implementation Findings and Lessons Learned

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Abstract: Learning and Integrating New Knowledge and Skills (LINKS) is a federally funded technology project designed to integrate established and emerging technologies into the teacher preparation curriculum at Texas Woman's University (TWU). The project is supported by a three-year USDE, Preparing Tomorrow's Teachers to Use Technology implementation grant. The project encourages institutionalized efforts for the teacher education program within the Professional Development School (PDS) to address technology proficiencies desired by these schools and recommended by the National Council for the Accreditation of Teacher Education (NCATE). The project prompts changes in university faculty involvement and roles, technology curriculum content and delivery, and preservice teachers' performance and responsibilities in field-based locations. This paper addresses issues regarding changes in behavior and attitudes as well as how these changes relate to faculty development. Specifically, these questions will be addressed: (a) to what extent did university instructors model technology proficiency in web-based curricular delivery; (b) what concerns did faculty express, and how did their concerns change over time; and (c) what early implementation lessons were learned to inform program improvement?

Perspective and Purpose

Recent research efforts have focused on concerns regarding individual attitudes and perceptions related to the integration of technology. Medcalf-Davenport (1999) contends that pre-service teachers often wonder why they are expected to focus on technology integration instruction in their teacher preparation courses when they are often times not "exposed to the uses of any technology in the school classrooms as they observe and do field experience" (p. 1424). Furthermore, Medcalf-Davenport asserts that pre-service teachers do not always have an opportunity to see teaching with technology modeled within their university classes due to a lack of technology proficient faculty. Researchers, professional educators, and policy makers all agree that teacher education should include technology in a systematic, structured manner, one that is interdisciplinary, not focusing strictly on education courses, but all courses education majors must take (Handler, Strudler, & Falba, 1998; Thomas, Larson, Clift, & Levin, 1996). Within these classes, faculty need to model technologically proficient and innovative means of integrating technology and pedagogy (Algozzine et al., 1999; Persichitte, Caffarella, & Tharp, 1999).

The purpose of related program evaluation and associated research inquiry of the LINKS project was to gauge the effectiveness of instructor training based on the Concerns Based Adoption Model (CBAM). The training component supported instructors' use of a web-based authoring tool, Blackboard, in the preparation of web-based course delivery. Because the instructors could be followed and supported as they adopted the innovation (i.e., use of Blackboard), the CBAM model was fully implemented with this population. Both the Stages of Concern Questionnaire (SoCQ) and the Levels of Use (LoU) were used to assess progress toward innovation adoption. Individual instructors completed the SoCQ electronically via the LINKS web site at the first and last training sessions, and individual interviews were conducted after the last of the five training sessions to assess instructors' Levels of Use (LoU). Evaluations of individual training sessions delivered in the pilot semester informed management and training adjustments in following semesters.

Methodology

Foundation and Guiding Questions

The evaluation and research inquiry was grounded in the CBAM (Hord, Rutherford, Huling-Austin, & Hall, 1987) that monitors changes as an innovation is implemented. Changes in instructors' technological proficiency over time, implementation concerns, and in some cases, levels of technology use were part of both evaluation and research efforts.

The broad questions related to the instructor / faculty strand that guided the study were as follows:

- To what extent did university instructors model technology proficiency in web-based curricular delivery?
- What concerns did faculty express, and how did their concerns change over time?
- What early implementation lessons were learned to inform program improvement and how did LINKS support the utilization of technology in teaching and learning for these populations?

Training

During spring 2000, faculty volunteers from various university disciplines that contribute to teacher education were enlisted for training as part of the first-year implementation of the LINKS project. There were two primary training goals: (a) to support the LINKS standards and resources, and (b) to support instructors in their delivery of web-based courses as models for the future teachers in their classes. This training strategy was selected due to suggestions in the research literature that there is a lack of modeling of technology use in university coursework (Smithey & Hough, 1999; Strudler & Wetzel, 1999).

A volunteer sample of university professors (N=20) agreed to participate in five whole-group professional development sessions. Sessions focused on an orientation to the Links project and resources, and the preparation of web-based course delivery via Blackboard—the university's web-based course delivery template. The training agenda for the instructors includes these elements:

- Project overview. Instructors participate in an initial whole-group orientation to the LINKS project and learn about the high levels of technology proficiency expected of Texas preservice teachers.
- Internet resources. In the second session, instructors explore Internet resources.
- Blackboard. The final three sessions address the use of Blackboard—the university's web-based course delivery template.
- Individual assistance. Individual assistance is available to instructors by request.

The sessions are designed as workshops, and instructors bring syllabi and other materials to use as they convert traditional courses to the electronic medium. All instructors who teach in the College of Professional Education, as well as instructors in other colleges and disciplines who teach basic and methods courses to preservice teachers prior to their enrollment in the professional education sequence, are invited to participate. This comprehensive approach allows preservice teachers to benefit from modeling provided by a varied community

of instructors, and they experience the use of technology within meaningful learning over the entire course of their college career.

Data Sources

The LINKS project evaluation included measuring the progress of university instructors at various phases, as well as assessing the utility and effectiveness of the LINKS training and resources. The data collection methods involved use of instruments, interviews, and surveys to explore concerns about technology use, level of technology use, and utility of the LINKS training. Pre- and posttest data were collected on the Stages of Concern Questionnaire (SoCQ) and data on the Levels of Use (LoU) were collected by individual interviews after the last of the five training sessions. Due to attrition, the final sample included 13 instructors. Analyses involved descriptive statistics and the creation of profiles.

Concerns About Technology

The Stages of Concern Questionnaire (SoCQ) monitors changes in attitudes and behaviors as an innovation is implemented. The SoCQ consists of 35 items that are rated on a 7-point Likert scale with three anchors: 1 (not true of me now), 4 (somewhat true of me now), and 7 (very true of me now). The instrument measures the intensity of concerns around three main clusters (self, task, and impact concerns). The technical qualities of the instrument are acceptable. Cronbach alpha coefficients of internal consistency range from .64 to .83, and the test-retest Pearson r correlations range from .65 to .86. The SoCQ was administered as a pretest and posttest to the Cohort 1 preservice teachers and university instructors. When completing the electronically-administered questionnaire, instructors were directed to "respond to the items in terms of your present concerns, or how you feel about your involvement or potential involvement with the use of educational technology." Educational technology was further defined for respondents according to the LINKS concepts of productivity, connectivity, and integration.

Technology Use

Data on instructors' Level of Use was collected through individual interviews conducted after the last of the five training sessions. Interviews centered on instructors' use of Blackboard. A detailed manual (Loucks, Newlove, & Hall, 1975) establishes a list of assessment objectives and questions, but the interviewer has latitude to improvise within the framework. Established interrater reliability indicates that it is fairly simple to reach 70% agreement.

Quality and Utility of Training

Instructors completed session evaluation forms at the end of the training sessions. The forms included both objective and open-ended items. First, instructors rated three items on a 10-point scale ranging from 1 (low) to 10 (high). The items addressed the training's possible (a) effect on positive attitudes toward technology use as a teacher, (b) increased comfort with technologies, and (c) improved ability to integrate technology into teaching and learning. Next, instructors completed three open-ended items: (a) What was the most important learning for you regarding technology integration? (b) What is your main concern regarding application of this information? and (c) What suggestions do you have for making the LINKS technology experience more effective?

Results

An overview of the findings for the instructor group during the first semester of project implementation under the three-year grant is offered. The primary goals for the university faculty were introduction of the LINKS standards and resources, and support for instructor delivery of web-based courses as models for the future teachers. The descriptive statistics and profiles for the SoCQ suggested that the instructors had relatively high informational and personal concerns as well as rather intense consequence and collaboration concerns. Changes reflected in exit interviews related to the variance in beginning use and the individual differences in progress attained during the semester. All individual instructors made significant progress in levels of use, although they

began at different levels. Qualitative analyses of open-ended evaluation questionnaire items revealed concerns with their own ability, the time needed, and the applicability of their new learning. Additional analyses of implementation data have been conducted and will be reviewed during the course of this paper presentation.

Problems or Concerns	Solutions Implemented
High information and personal concerns such as limited technical skills and lack of time	Invite pilot study group to return for Year 2 sessions
Intense consequence and collaboration concerns involving course content and students' work	Expanded training sessions over the course of two semesters
Support after individual session completion.	Individual assistance in LINKS Center or instructor's office.
	Included content related to pedagogy
	Offered the use of a PC laptop for the duration of the training sessions
	Offered varied training opportunities in addition to weekly meetings • Brown-bag sessions • On-line courses

Table 1: Changes based on first year findings.

Session	Dates	*N*	Motivated to Use Technology	More Effective on Job	Overall Rating
Orientation	9/13	14	4.3	4.5	5.1
Exploring Internet Resources	9/20	12	5.0	5.2	5.5
Searching without Losing Your Composure	9/27	15	4.6	5.1	5.4
Introduction to Blackboard	10/18	9	4.8	5.5	5.9
Exploration of Blackboard	1/31	14	4.8	4.6	5.3
Adventures in Uploading for the Tentative	2/7	17	4.4	5.0	5.0
Cliffwalking on the Rocky Blackboard Range	2/14	12	5.2	5.3	5.5
Refinement of Blackboard	2/28	8	5.5	5.3	5.4
Beyond Simple Documents	3/14	10	5.7	5.3	5.7
Braving New Frontiers	3/28	8	5.3	5.1	5.6

Table 2: University instructors' ratings for individual training sessions. Items rated on a 6-point scale.

Implications

The wide variance in university instructor's technological proficiencies indicated in the findings require educational planners to address simultaneously learners' diversity and the "moving target" of technology. For this project, university instructors showed a high level of interest in participating in the LINKS program that supported web-based course delivery. Instructors varied significantly in their original technology proficiency levels, but they made substantial progress from their starting points. The key instructor concerns revealed in the evaluation were (a) the need for and management of time, (b) their individual technical proficiencies, (c) the applicability of Blackboard to their own teaching, and (d) their need for continuing support. To address expanded support, 14 training sessions were implemented in 2000-2001. University instructors were supported over the entire academic year, and they were provided with laptops for this effort. The outcome in the near future will be a web-based course offered by each participant. Support from the LINKS team during and between training sessions was expanded and documented for evaluation purposes. This group of instructors

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completed 14 training sessions during the second year of the project implementation. Discussion regarding the nature of these sessions and preliminary understandings will be encouraged during the course of the presentation.

Technology knowledge and skills
Awareness and knowledge of resources
Information about LINKS and LINKS activities
Ability to integrate technology into the classroom
Confidence using technology
Identification of areas for additional improvement

Table 3: Areas of learning most commonly identified by university instructors, ordered by frequency.

	Pretest (F00)		**Posttest (S01)**			**Paired**
Cohort 2	*Mean*	*SD*	*Mean*	*SD*	*Difference*	*T-test*
Self						
Awareness	2.36	1.38	1.70	0.89	-0.66	*
Informational	4.64	1.86	3.57	1.34	-1.08	*
Personal	4.59	1.57	4.59	1.69	.01	--
Task						
Management	3.76	1.81	4.01	1.88	.26	--
Impact						
Consequence	4.79	1.52	5.04	1.16	.26	--
Collaboration	4.63	1.18	4.77	1.34	.14	--
Refocusing	3.61	1.19	4.29	1.33	.67	--

Table 4: Stages of Concern rubrics for university instructors. Statistics based on 14 valid matched pairs using paired-samples *t*-tests. * $p < .05$. Ratings made on a 7-point scale with three anchors: 1 (*not true of me now*), 4 (*somewhat true of me now*), and 7 (*very true of me now*).

Educational Importance

Despite the attention given to technology's benefits, the USDE finds that "relatively few teachers (20%) report feeling well prepared to integrate educational technology into classroom instruction" (2000a). The USDE goes as far as to say that "teachers have been prepared for a model of teaching dramatically out of step with what is needed to prepare the nation's students for the challenges they will face in the future" (USDE, 2000b). Findings regarding the implementation and effectiveness of the new LINKS project within the teacher education program has implications for increasing the technology proficiencies of entry-level teachers as well as providing a model for other universities undertaking similar changes in teacher preparation programs. Furthermore, the resources created by LINKS are continuously available to other institutions on the project website (http://venus.twu.edu/~f_snider/links.html). Findings have particular relevance to explain how university professors can be supported as effective models of technology use in web-based course delivery and electronic communication with students.

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Individual Learning Process in Designing Hypermedia

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Most students cannot develop complex learning skills naturally. They have difficulty with acquiring complex knowledge. Hypermedia promises to accommodate individual differences enabling students to learn equally well. However, research reports have shown that not every student can benefit from hypermedia learning, because students need complex learning skills to manage the specific hypermedia learning environment. It is important to conduct effective individual difference research in order to provide information helpful to the instructional designers. In this paper, 12 studies are divided into five categories according to current significant research groups in the hypermedia field. Learning from the learner's perspective is discussed.

Scaling Online Communities with Javamlm

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Abstract: Unmoderated computer-mediated discussion groups suffer from the paradox that the more successful they are, the more difficult they are to use and administer, because of the increasing number of users and discussions. Traditional solutions to this problem, such as creating static subgroups or requiring Web access, can change the nature of the community in undesired ways. We discuss the shortcomings of traditional solutions and present an approach to scaling online communities that we believe increases, rather than decreases, communication opportunities without overwhelming users or administrators.

Introduction

Systers is an unmoderated email list for women in computer science, originally created in 1987 for 12 women (Borg 1993). The list has been tremendously successful at creating a community for people who had felt isolated, growing to include over 2300 members in 38 countries. As Systers has grown, however, it has lost hundreds of members, especially senior women, because of the increased message volume that has come with increased membership. Additionally, members have felt less free to post to the entire list, instead responding directly to the sender of a message or not at all, reducing the sense of community and the utility of the list. Our goal is to provide a better format for such a large community than an unmoderated email list, while keeping the features that make Systers successful.

Rejected Alternatives

A common general solution to heavy volume on mailing lists is moderation, which can be performed top-down by a small set of administrators or bottom-up through collaborative filtering. While the most obvious cost of moderation is the human overhead required, a more fundamental problem is that moderation schemes limit diversity through the "tyranny of the majority". A topic of little interest to the majority may be of great interest and value to a minority. A better scheme (which we describe below) would allow users to customize which messages they see.

A conventional alternative to moderation would be creating static subgroups of Systers interested in particular topics. There might be technical groups focused on Web design, groups discussing how best to deal with maternity leave, or support groups for women in the final stages of their dissertations. However, while an individual Syster may not be interested enough in maternity leave to join a group that discusses it exclusively, part of what members find valuable is hearing about other women's experiences in a wide range of areas, especially ones they might be relevant in the future. Thus, completely eliminating the sharing of information about maternity leave with the broader group lessens the value of the list. In the limit, there would be no common discussion among the entire group, just a vast collection of special interests. For these reasons, we rejected the idea of relying primarily on static sublists.

The most obvious way to support customized views is to go to a Web-based, newsgroup-like format, where Systers can browse the topics that interest them. Because is it not email-based, this solution would be unacceptable to many long-time Systers, who have expressed a preference for email, as well as to members in poorer countries with less Internet connectivity. It also removes the immediacy of the information, since most Systers would check the web site at most daily or weekly, which would change the feel of the community.

Our Proposal

We have a solution that we believe meets many of our design goals. Our system, called Javamlm, is oriented around *conversations*. Members would be able to subscribe to or unsubscribe from individual conversations while remaining subscribed to the list. The opening message of a conversation would be sent to all members. When a member signs up to Systers, she specifies whether she wants to see all messages or only the first message of each conversation. The default behavior is for users to be subscribed to all conversations in order

to mimic the behavior of the current system. Users may also specify whether they prefer to receive messages as plain or formatted (html) text.

A member creates a new conversation by sending an introductory message to systers-new@systers.org. If she wishes to name the conversation "conferences", for example, rather than having a system-assigned name, she would send her introductory message to systers-new-conferences@systers.org. All members would then receive the first message in this new conversation. If a recipient wishes for her default preference (e.g., "view all messages in new conversations") to apply, she need not do anything. If she wishes to override her default preference, she clicks on an embedded link or replies to an indicated email address, which automatically processes her request. If she wishes to contribute to the conversation, she simply replies to the message and the message is properly directed.

Planned future functionality would give users the option of seeing only the first and last (summary) message in a conversation or receiving the messages as bundled digests. Observe that no administrator overhead is required to honor users' preferences.

Conversations could exist for a limited period of time or be permanent. Under the current system, a volunteer collects job listings and posts them to the list once per week. She also forwards them immediately to Systers who are looking for employment. Having a "systers-jobs" conversation would eliminate the human administration costs while *increasing* functionality. An individual could specify any of the following behaviors:

- Receiving each job posting immediately
- Receiving digests of job listings on a daily, weekly, or monthly basis
- Never seeing job listings

At any time, she could change her preference without going through a human administrator. Additional planned functionality would allow users to receive messages containing individually specified keywords. For example, a member looking for a faculty position might choose to see all messages containing "faculty" or "professor".

Status

We have built the Java Mailing List Manager (javamlm), which provides the described functionality and a number of additional features designed to minimize administration cost, such as archiving and variable envelope return paths [1], which simplify the handling of bounced messages. Information about users, conversations, and messages in kept in a relational database. We are currently using Postgres as our database management system. We have also built a Web interface to the database for users and administrators using AOLserver and Tcl. All of these tools are open source, which will allow us to release the entire package for free modification and distribution.

We have conducted a small user test, which showed the need for improved instructions and user interfaces for subscribers not already familiar with threaded discussion forums. User interface design is particularly difficult for subscribers with text-only mail programs.

Acknowledgments

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The Impact Of Current Data Compression Technology On Design Strategies For The Development Of Distance Learning Courseware The Original Design Of The Anatomy Of Music

Music appreciation is commonly defined as a course of study for developing in students the ability to listen intelligently to music.2 As an academic discipline, it is unique to England and the USA where it has blossomed since the twentieth century. Educational objectives have increased far beyond the listening component, and today include fundamentals of music theory, music history, music literature, ethnic and folk music, and biographical information of composers and performers.

Designing courseware for a distance learning music appreciation course required that students attain access to all the necessary course materials, including the required music excerpts, in order to be able to study for the course at any location and at any time. It also required establishing an effective communication vehicle between students and their instructor.

The most important question confronting designers of any courseware conceived for a virtual classroom has to be its didactic validity. Specifically, will the courseware be conducive to teaching the course's content as well as or better than a traditional classroom experience? How would it substitute for the instructor's presence in a conventional classroom? How can we design tests that are not only reliable and valid but also contain a high level of security? How can the courseware provide the instructor with some measure of flexibility in an essentially static, prepackaged course?

The design of The Anatomy of Music attempted to provide answers to these and other questions. The overall course objective, for which the courseware was designed, was to foster in the students connoisseurship of classical music. Since students who enroll in a music appreciation course constitute mainly non-music majors, every part of the content material had to be presented at a technical level deemed appropriate for such a student body.

Though most, if not all, music appreciation texts contain musical notation, the use of notation for the study of musical excerpts was avoided in the design of this courseware. Musical notation is a highly technical subject and cannot be learned incidentally as part of a one semester course. The inclusion of notation in music appreciation texts is based on study methods borrowed from musicology. The discipline of musicology bases its study of music almost entirely on musical scores. An alternative method for "showing" the music had to be developed for this courseware. Another design issue that had to be confronted was the fact that students in general require various lengths of time to attain understanding of new materials. This is especially true if the attainment of understanding pertains to non-verbal material and has to be achieved by listening to music.

Based on these as well as other concerns, the courseware design introduced three different modes for presenting the materials: 1) a verbal mode for historical and biographical information; 2) an audio mode for the musical selections; 3) a visual mode substituting for musical notation. These three modes were incorporated in a computer program. The verbal mode was made up of text files, and the audio mode was made up of three specifically-created CDs that stored all the music needed for the courseware and that were activated via the CD-ROM drive. The visual mode was created by graphical representations of musical compositions on the CDs and thus was linked to and synchronized with the audio mode. The interactive design of these graphics enabled students to click repeatedly on various locations along the musical composition until auditory comprehension of specific information was achieved.

The complete courseware packets included a workbook, three music CDs, and the application program on floppy disks. A course home page was created and served as the communication vehicle between all participants in the course. It was also used to upload and download files containing tests, and to post quizzes and other course related information. Students worked on the course material off-line. Once they completed a test, they uploaded it from the home page to a server. Thus, the course was self-paced (within

limits) and asynchronous.

The Anatomy of Music courseware has now been in use for a number of years. It served as the main content text and learning tool for a Web mediated distance learning introduction to music course offered at Northeastern University in Boston. The course was named "Music: A Listening Experience" and because of high demand, enrollments had to be limited to one hundred students per section. Notwithstanding the unusual success of the courseware in its use at Northeastern University and the positive attention it received nationally,3 some critical flaws became apparent. The inherently static nature of the courseware, caused by confining the course content to the music on the specifically-created CDs and the interacting hypermedia computer program, limited the usefulness of the courseware to the person who created the courseware. The courseware presented a packaged course of only one instructor's ideas about a particular discipline.

THE MP3 ADVANTAGE FOR THE AUDIO MODE IN COURSEWARE DESIGN

The storage capacity of a CD is about 650 MB. In terms of music storage, this means about 70 minutes of musical recording. The phenomenal MP3 compression technology can increase this storage capacity by a factor of 90. In other words, MP3 compression can reduce the size of a music file to 1/ 90 of the original size it had on a conventional CD. Consequently, the MP3 compression technology makes it possible to reduce large music files to sizes well within realistic memory capacities of today's average computer. This means that whereas previously CD-ROM technology was the only practical solution for reading from files that had to be stored on CDs because they contained large quantities of data, the same amount of data can now be compressed enough to be stored easily on a computer's hard disk.

Another important observation to be made is that this compression can be performed without significantly sacrificing any of the originally recorded audio quality.

The new compression technology holds significant implications for designers of any courseware requiring large quantities of data that has to be made available to the learner. If previously the content data of a particular courseware program required several CDs, as it did in The Anatomy of Music, it would have been utterly impractical to store this data on a server for students to download to their computers. In general, the new compression technology eliminates the need to create CDs for storage of large quantities of data. Compressed files can easily be created and distributed to students via the Internet, and students can download these files to their computers with relative ease.

The implications for the design of music courseware are quite obvious. By using a ripping tool, a designer can easily select musical excerpts from any CD, modify the audio mode of the courseware as needed, and distribute these to the learner. There is no difficulty in distributing the attendant application program for the audio-visual mode or the verbal (text files) mode. As was true with the creation of the CDs for The Anatomy of Music, a license agreement has to be reached with the recording company that created the original CD.

NEW CONCEPTS IN COURSEWARE DESIGN

Any courseware packet that is made up of a software application and needs CDs to store its main content material, is by necessity immutable and thus confined to data that is included on the CD and to what the attendant software application was designed to do. Obviously, this limits the usefulness of the courseware to instructors who are in full agreement with the creator of the courseware as to the course's objectives, content and teaching methodology. This is comparable to asking an instructor to teach along a single text. By design, a CD-ROM is a fixed entity that cannot be changed or modified. Once created, it becomes as static in its content as a book. It can only be modified by the creation of a new edition or version, a cumbersome process that can be performed only very infrequently.

Many new possibilities have opened up with the advent of the new compression technology. Instead of designing a self-contained, stand-alone courseware packet, the designer can now create course modules. For the discipline of music appreciation, each course module would contain the same three presentation modes as the original courseware packet, i.e., verbal, audio, and audio-visual. What differentiates the

module from the courseware packet is that modules will encompass a specific topic of a course. For example, a module could concentrate on a single topic such as "The violin concertos of Mozart" or "Symphony no. 1 by Johannes Brahms." Any number of such modules can be prepared by the designer, placed on a server, and thus be made available to instructors and each of their students. This is akin to creating the foundation for a continuously growing library. The difference here, is that instead of books the library will contain a collection of course modules.

For instructors, this provides almost unlimited flexibility in designing their own course. Instead of having to use a pre-packaged course, instructors could now select from different course content items, as they exist in the library of modules, and shape a course that is more attuned to their own educational philosophy.

Another possibility created by the module concept is that instructors could request the designer to create modules in accordance with their own specific needs. For example, an instructor could ask for a module on "The mass of the Fifteenth Century," and if interested, even provide the designer with the appropriate text files and a list of the requested compositions to be included in the module.

The possibilities that such collaboration between the end-user and course content designer can generate are unprecedented, uncharted, and essentially boundless. The course module concept opens an entirely new paradigm for the creation of educational materials that has never existed in the past and that would not have been possible before the advent of the latest educational technology.

Though the implications discussed throughout this paper apply mainly to issues related specifically to distance learning, the proposed concept of course content modules is not necessarily limited to that particular mode of educational delivery. Even traditional classes can easily make use of a module library for assignments of homework. Rather than require students to read about a particular topic or listen to a recording of a specific composition, instructors would be able to have students download a specified module that contains all the requested resources. With the module on their computer, students could study all the required materials and practice the listening assignments until fully comprehended. This new modular concept for the creation of educational material could change that basic approach to the development of academic related texts or courseware from static to dynamic. In the discipline of music, where the audio component requirements demand inordinately high data storage capacities, the change from static courseware to dynamic would not be possible without the availability of high powered compression technology such as MP3.

1 The Anatomy of Music is a hypermedia courseware program for a music appreciation course.
2 W. Apel, Harvard Dictionary of Music, Harvard University Press, Cambridge, MA, 1969.
3 See Education Supplement, NY Times, April 4, 1999.

ALE - Adaptive Learning Environment

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Abstract: The Adaptive Learning Environment (ALE) is a WWW-based tutoring framework which combines methods of knowledge representation, information contextualisation, instructional planning, and adaptive media generation to deliver individualized courseware over the WWW. ALE is one component of a virtual university for architecture and design developed in the European project WINDS1. It is based on a content model of the subject matter and a structural model of course materials, a pedagogical model on how to teach a curriculum, and learner modeling on different levels, e.g., preferences, interests, and knowledge. Based on these four components individualized and contextualised web-content (html, java, pictures) is generated and presented to the learners. Additionally a pedagogical agent in ALE is able to make recommendations for switching between individual and cooperative learning activities and find advanced or expert students in relation to one's own profile. Beside goal oriented expository learning approaches the ALE framework also supports exploratory learning where students can use the content model to have a different view on the domain than provided by the course structure given by the teacher.

1. Introduction

The ALE framework utilizes hypermedia technologies and AI methods to deliver individualized hypermedia instruction. The framework is comparable to the ACE framework described in [1]. Different learning strategies are supported by ALE: expository learning, where students follow predefined paths through presented learning materials and exploratory learning, where students explore learning materials on their own. Furthermore awareness information integrated into the ALE learner portal and course interface support synchronous and asynchronous learning in learner groups.

Besides the adaptation of a goal oriented instructional process the integration of cooperative learning components in ALE enables the support of a wider range of learning activities and individual styles of learning. Students can now learn in ALE only by discussing with other students but also by following the individualized guidance of a pedagogical agent through all available learning materials. The only criteria for a successful learning path are the knowledge test results of a student at the end of a learning unit or even a curriculum.

A key idea to support the different teaching and learning styles is the contextualisation of all learning materials using different contextualisation strategies: structure-based, content-based, and experience-based.

2. Integrating individualized and cooperative learning

In the following section we will give a rough overview over the ALE components. Most classical Intelligent Tutoring Systems (ITS) [2] include aspects of knowledge representation, tutorial components and learner modeling in the upper sense to achieve the goal of individualized instruction. Accordingly, the ALE architecture consists of four main models:

The *structural model* describes the Learning-Units of the domain and their interrelations and dependencies, the *content model* comprises the concepts to be learned, the *pedagogical model* contains pedagogical strategies and diagnostic knowledge and the *learner model* stores the preferred settings of a learner, the domain concepts and learning units a learner worked on, and the interface components used by the learner. We will discuss each of these models in turn.

With each of the Learning-Units described in the structural model different type of learning materials are connected. Each of these learning materials as such has a different pedagogical role in the teaching process. An overview is given in Table 1. All Learning-Units are stored in a LOM (IEEE LTSC) compatible format to be highly reusable in different contexts of learning.

All interactions of a learner with the objects of the curriculum are represented in interaction episodes. These interaction episodes are the input to the *learner model*. They contain a time stamp, the identifier of the unit involved, the material presented, material specific extensions, and the modality a material was presented to the learner (text, audio, video). Whenever the learner requests an object or gets a presentation an interaction episode is send to the learner model and the corresponding part of the learner model is updated.

The *pedagogical model* represents the teacher's knowledge of how to teach units. Teachers follow different strategies to teach different types of concepts. Teaching strategies in this sense are comparable to the teaching rules in Vassileva [3]. For example, when teaching statistics, introducing the arithmetic mean as a well defined and formalized concept can easily be done with a deductive strategy of sequencing some explanations (text, a formula, computing tests). In contrast, it is very hard to "explain" a more abstract or ill-defined concept with a text or a formula. For introducing a less defined concept, e.g., teaching a design method in architecture, it would be much easier to follow an inductive approach (start with concrete examples and moderated discussions and let the students gain there own abstraction and understanding of the concept). Such different strategies in the sense of a certain sequence of learning activities are defined in the teaching strategies. The system has a default strategy for each Learning-Unit and authors can specify a preferred strategy for each concept if needed.

Modifications of the default strategy can be triggered by the contents of the learner model. For example if the student has already seen some of these learning materials they will be skipped, or if the student has already worked on tests about this concept successfully the system will modify the presentation and just present some advanced examples and the summary about this concept. Furthermore, if the system detects prerequisites for the requested concept that the learner did not work on, the system integrates a diagnostic module for the prerequisite units in the presentation of the current unit. Beside teaching strategies for the sequencing of individual learning activities rules for switching from individual learning to group activities are defined. On the one hand if a student gets stuck with working on the tests in a learning unit but has worked on all the available materials in the system, recommendations will guide the student to discussion forums or advanced students like described in section 3.1. On the other hand students mostly working in cooperative activities will be guided to diagnostic components to track their progress from time to time. Depending on the teacher's specifications of the course teaching strategy the system will be more or less intrusive and force the student to answer knowledge tests.

The *structural model* offers a way to structure learning materials by defining default paths. This allows to determine sequences of learning units a student should ideally follow when working with a certain course. The *content model* in turn captures in an abstract way the domain concepts that are taught in a course. It offers a separate layer independent of the concrete learning materials. This separation of abstract concept layer and concrete learning materials reflects the fact that the same concept may be taught using different materials. Having the domain concepts represented in the learner model, it is possible to indicate whether a certain concept has been understood or not. This is complementary to the indication that a certain learning unit has been worked with.

3. Learning with ALE

When students log into ALE they get an individualized learner portal, where they can book courses, contact courseware authors and other learners, maintain and update their profile, and have a collection of resources linked to that page. Additionally students get some awareness information about current online discussions, teacher's online lessons in their booked courses, and co-learners that are present on the ALE server. From their personal ALE portal they start working on their booked courses.

Based on the learner model, the content model, the structural model, and the pedagogical model the presentation component of ALE selects appropriate learning units and generates individual hypermedia documents. When a learner requests information about a learning unit, the ALE system checks if the learner has already mastered the requested unit or has seen some material about this unit (I). In a second step the system looks up relations and available materials for the requested unit (II). In a third step the presentation component retrieves a plan for presenting the unit depending on the available learning materials for this unit, the knowledge of the learner, and the teaching rules and pedagogical specifications of the course author (III). The retrieved plan describes the presentation of the requested unit, which is translated into HTML by the presentation component. Throughout the whole course the learner's knowledge is tested so that the system can adapt to the dynamically changing knowledge, interests, and preferences of the learner.

3.1. Adaptive Methods in ALE

In ALE several adaptable and adaptive methods have been implemented. These adaptive methods have been evaluated in several empirical studies in earlier prototypes by Specht [4].The main groups of the implemented adaptive methods are in the field of adaptive navigation support, adaptive sequencing, adaptive recommendation, and pedagogical agent support. Furthermore experimental studies have been carried out on critical design issues of ALE. Central questions have been the user interaction with adaptive components, and the impact of adaptive methods on learning time and knowledge gain [4]. Extensions have recently been made to the adaptive support of cooperative learning activities, this helps the students to find available co-learners and experts by awareness information and intelligent profile matching.

3.1.1. Adaptive navigation support

Adaptive navigation support [5] is one of the most popular applications of adaptive presentation to the hypertext metaphor. ALE currently implements two methods of adaptive navigation support: Adaptive annotation and incremental linking of hyperlinks.

Adaptive annotation of hyperlinks supplies the user with additional information about the content behind a hyperlink. The annotation is adapted to the individual user by taking the learner's knowledge and relations of the units to be learned into account. Concepts which the learner is not ready to learn (because of lacking prerequisites) are presented with a red ball, recommended concepts are annotated with a green ball, and hyperlinks to units that are not recommended but have no lacking prerequisites are shown with an orange ball. Implementations of adaptive annotation can be found in different variants in [5]. Furthermore also several experimental studies [6, 7] have investigated on the effects of these variations. The current form of adaptive annotation implemented in ALE [8] showed to increase learning speed and that students gain a better understanding of learned contents when combined with incremental linking. Furthermore a central finding was that more open forms of adaptive annotation are preferred by learners with higher prior knowledge, while students with low prior knowledge seem to be more active and gain a better understanding in more restrictive forms of adaptive annotation [9].

In the area of adaptive interfaces the problem of overload in complex interfaces is often solved with the adaptive method of incremental interface. Elements of the interface and tasks manipulating these elements are incrementally introduced to a learner according to their difficulty and complexity and already mastered objects. Texts in ALE can contain keywords to related concepts that are not learned by a student yet. If a text is presented to a student first, it will contain no hyperlinks to the related but not yet learned concepts. After working with the system, ALE will present all text keywords with hyperlinks to already mastered concepts and ready-to-learn concepts. Building an individual index in the learner model allows the system to present exactly these links in a text a learner is ready to visit, and units that are too complex are presented as plain text. Incremental linking is a very restricting form of adaptive guidance for learners. Experimental studies within ALE showed that the successful application of incremental linking is strongly dependent on students' learning style and their prior knowledge [10]. Following these studies a major criteria for the adequate implementation of adaptive navigation support in learning environments appears to be the right balance between navigational support through annotation and guidance through incremental linking.

3.1.2. Adaptive sequencing

In ALE the sequence of learning steps is adapted on two main levels, e.g., the system gives proposals for sequencing of whole learning units and the system adapts the sequence of media available for a unit. The sequencing algorithms are based on pedagogical models of Salomon [11] for overcoming knowledge deficits, compensating more general deficits, and adapting to preferences. Through a combination of different categories of sequencing algorithms specified by Frank [12] adaptive sequencing can be used in all three models of Salomon. The adaptive sequencing component tries to keep the student on an optimal path based on the student's current knowledge. Furthermore, it adapts the sequence to the interests specified by the student. The optimized path for a student is computed dynamically and every action of the student can have an impact on the computed result. For example solving tests for a section makes it possible for the student to skip all sections and concepts contained in that section. Learners can start to work on the curriculum wherever they want. When a student selects a unit the system checks if a learner lacks any prerequisite knowledge to work on this unit and presents tests for lacking prerequisites. If a learner is not able to solve the given tasks, the system recommends to work on the prerequisites. Given any given point in the curriculum, ALE can compute the next best unit depending on the probabilistic overlay model of a learner's knowledge and the prerequisites of possible next units.

In one experiment conducted, the individual generation of an introductory lesson showed no significant effects on the knowledge gained. In tendency the results confirm that the prior knowledge of learners has a strong impact on the learning success with adaptive hypermedia [4]. Furthermore the effects of the explicit warning and recommendation of prerequisite units were confounded by the adaptive navigation support. To validate the results experimental studies on this single adaptive support should be done.

Evaluations have shown that students that are following sequencing proposals adapted to their domain knowledge and interests gain a better understanding of the domain in shorter learning time [13].

3.1.3. Recommendations of a pedagogical agent

In ALE a pedagogical agent was implemented to give individualized recommendations to students dependent from their knowledge, their interests and their media preferences [13]. The implicitly given teaching goals were promoting and retaining learner motivation and evoking students' interest even in lessons they otherwise might have avoided.

Beside recommendations of learning material to study the recommendations of the pedagogical agent where extended to propose cooperative activities and contact to other students that are willing to support others. Table 2

shows some type of recommendations given by the agent:

Another feature attached to the agent was the visualization of the learner model. Learners could access a bar chart display of the current knowledge model in the system. From the bar chart they could directly jump to tests about a section to proof that they have better knowledge than assumed by the system. In the experiment done with ADI and the user model visualization the usage of the agent components were voluntary and the learners rarely used this feature. Therefore additional evaluations have to be done. The overall results showed that students following the learning material recommendations of the agent gained a better understanding, had more fun, and worked more intense [13].

3.2. Cooperative knowledge collection and adaptive co-learner finding

With the integration of student workspaces into the ALE framework new courses can only consist of a given curriculum structure prepared by a teacher while the contents and learning materials are completely collected by the students. This allows teachers to implement basic courseware that is integrated with the growing knowledge of the learner community and develops towards a living repository of knowledge which includes frequently asked questions, best practice solutions, and open space courseware.

Like described in section 3.1 students can ask the assistant for online co-learners and topic experts. Furthermore with every presentation of a learning unit the currently available students that are willing to cooperate are shown to the student. The selection of appropriate co-learners is based on a comparison of the student's knowledge model and the other students' knowledge model. Students that are willing to cooperate with others can get a contact point to very similar students or to very different students in sense of there curriculum expertise. This can lead to very heterogeneous learner groups that consist of topic experts in selected areas or to very homogenous learner groups that consist of experts on the same topic. The expertise of a student on a certain topic is measured with four main criteria: The number of wrong test answers when working on knowledge tests, the time to answer sufficiently enough knowledge tests, the collection of additional learning material in student workspaces that has high request rates by many other students, and the overall score in the curriculum.

The learner groups can work in discussion forums, synchronous moderated chat sessions or communicate via integrated email.

3.3. Expository and exploratory learning

A teacher preparing a course usually has a strategy of how to present the materials to her students in mind. This strategy is reflected in the sequence she organizes the course units. Learning the course materials following this predefined structure is called *expository learning*. A different way of learning is *exploratory learning*, where students leave the predefined paths and explore learning materials on their own, based on their interests and current needs.

ALE offers support for both learning styles based on the key concept of contextualised learning materials. Three contextualisation strategies are used to guide the student's learning process: structure-based, contentbased, and experience-based contextualisation.

The structural model of learning materials (see section 2, fig. 1), setting up paths through courses is used for structure-based contextualisation. Using structural models single units are put into the context of a course adding a structural layer that helps to follow the materials step-by-step. The structural model is mainly used to support expository learning.

Content-based contextualisation is supported using the content models. Within the content models graphs of concepts and relations among them offer an explorable structure of information units courses deal with. These rather abstractly defined concepts are linked to the learning units they appear in. The relations between different concepts support an exploratory learning style, by guiding the student to related learning materials regardless of the sequence of units. We use a technique called concept indexing (see next subsection) to maintain the interrelationship between concepts and learning units.

The third contextualisation strategy, experience-based contextualisation, is based on the learner model. The learner model offers an individualized form of contextualisation that keeps track of concepts and learning units the student has already worked with. This offers a way to monitor an individuals progress. The third form of contextualisation is important in expository and exploratory learning.

3.3.1. Concept indexing

The teachers task is to define learning units, a structural model to define sequences through the units and a content model to define the conceptual representation of a course. To define the interrelation between the content model and

the course materials (thus contextualising the course materials with the content model) is a time consuming task, as every learning unit has to be searched for occurrences of defined concepts.

The concept indexing component is designed to support exactly this task. It takes course materials and the content model as input, parses all materials for occurrences of concepts (which may have several linguistic variants or synonyms) and maintains a set of occurrences for every concept, indicating which learning materials they appear in. Additionally it is possible to manually add explicit links between concepts and learning materials (e.g. to link concepts to images).

Figure 2 depicts the data structure underlying the content models. The basic entities are concepts, which are identified by unique names. Different concepts may be related using relations of different types. Every concept is associated to a set of variants describing different synonyms to the same concept. Each variant comprises a set of atoms. An atom is a phrase or a single word. Variants are further linked to occurrences, which represent the bridge between the content model and the course materials, by linking. An occurrence links a variant (and thus consequently a concept) to a specific document (or course unit).

To create and maintain this data structure, the concept index parser takes the list of all variants as input and searches for occurrences of them in all course materials, linking all found variants to the corresponding materials. When the parsed course materials are browsed by a student, the visual representation of the unit is extended by highlighting all occurrences of concepts and linking these occurrences to concept descriptions in the content model.

Now, how does the content model together with the concept indexing component facilitate exploratory learning? Instead of following the predefined paths through the learning materials a student may now take the following approach:

- Using the content model as a starting point she starts with a concept of interest.
- The indexing component displays a list with occurrences of this concept.
- The student browses through some of these materials
- Thereby, she discovers new interesting (indexed) concepts that are highlighted in the displayed materials
- Clicking on the underlying links will display the selected concept in the concept browser
- Again, materials related to the selected concept may be displayed, but alternatively related concepts may be found by following concept relations

This process may now continue having alternating sequences of concept browsing and course material browsing. Of course this strategy can also be combined with the expository approach, where a student starts reading course materials step-by-step and then steps out of the line to follow some concept links to discover related materials.

4. Summary and perspective

In this paper we sketched the architecture of the framework for adaptable and adaptive learning environments on the WWW. Integrating a content model, a structural model, a learner model, and a pedagogical model allows several adaptive methods to be implemented. The adaptive methods implemented in the framework are based on the pedagogical background of adaptive instruction and the psychology of learning. The basic ideas of this background are applied in the relatively new area of hypermedia courseware and are evaluated in this application field.

The ALE framework supports cooperative learning materials and activities, expert finding, information contextualisation and integrated awareness information. A course can range from a goal oriented drill/practice course to a structured collection of arbitrary learning materials by students. In the one case an author prepares a clearly defined curriculum with contents and a highly restricted sequence of individual learning materials. In the other case the author prepares a curriculum structure with an associated target competence definition (knowledge tests) and the students need to build their own knowledge base and collect course contents. Additionally different learning strategies, ranging from expository learning to exploratory learning, including combinations of both are supported.

Further integration of cooperative components for authoring and cooperative learning are planed and will try to follow the idea of adaptive cooperation and learning support.

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Statewide Collaborative Web Resources for Faculty Supporting Information Literacy

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Librarians and faculty working together through Utah's Academic Library Consortium (UALC) are developing a Web site to share library instruction and information literacy competency support materials statewide. These materials include handouts, guides, tutorials, interactive exercises, glossaries, lists of Web links, and assessment instruments. Through Web based sharing, each institution saves a great deal of time and effort by reducing the need for duplication of resources and increasing the quality of resources.

Background:

The Utah Academic Library Consortium (http://www.ualc.net) was established in 1973 and has developed many cooperative programs for collection development and resource sharing. UALC includes 14 academic libraries at 11 colleges and universities. Nine of these are public and two are private institutions. It includes five universities, four community colleges, two colleges and the Utah State Library Division. The mission of UALC is "to cooperate in continually improving the availability and delivery of library and information services to the higher education community and to the State of Utah." There were over 126,000 students enrolled in UALC institutions in Fall 2000.

Previous UALC collaborations have involved statewide collection management for serials and online databases (Pioneer Utah's Online Library, http://pioneer.lib.ut.us/), reciprocal borrowing, and electronic article delivery services. One of the latest programs being developed is a Web site to share library instruction and information literacy competency support materials across Utah. This project grew out of the need for a statewide clearinghouse for library instruction materials and from the redesign of UALC's online information literacy course, The Internet Navigator (http://www-navigator.utah.edu). The Faculty Resource Web site also builds on the national instruction material clearing house model developed by LOEX (Library Orientation Exchange) in Michigan in the 1970's. As more shared databases are made available, library and Internet instruction needs are becoming more similar across institutional and geographic boundaries.

Many of the resources on the new Faculty Resource Web site were originally developed for the Internet Navigator online course. The UALC online course consists of six modules, each with its own exercises, assignments, quiz, and glossary. This course has been used successfully by thousands of distance and online learners throughout Utah and beyond since 1995. A team of librarians and faculty from throughout the state of Utah worked during Spring and Summer of 2000 to completely redesign the course in order to address the dynamic changes in library information environments and to meet the latest information needs of students. As the new content was being developed, the UALC team members realized the value of having access to much of the content in a variety of formats for multiple uses, independent of the larger course, as needed. For example, the chapter in the course on "Selecting a Research Topic" could also be used as a handout or Web based reading for many other instruction sessions outside of the Internet Navigator course. A decision was made to develop a generic header and provide the same content in a "stand-alone" format for use in any other traditional face-to-face or online instruction sessions. This was the beginning of the Faculty Resource Web site.

UALC Faculty Resource Web Site:

The Web site idea grew from a few handouts to a more comprehensive clearinghouse of instruction materials. Although librarians and faculty have shared materials in the past, the Web site makes this much easier and more effective. A graphic designer was hired to design a generic layout for the materials. The Web site contains three main sections, plus a suggestion form. These sections are:

1) **Instructors Pages:** These pages are designed to be used by new Internet Navigator instructors. This section provides guidelines for teaching the course, including suggested grading rubrics, links to the grade database, and standardized email replies. Most of the links in this section are password-protected and accessible only to current course instructors. Also included is a course FAQ, which includes links of supplemental information for students, should they have problems with course sections. Many of these FAQs link to information in the following two sections.

2) **Instruction Handouts:** This section is a clearinghouse of instructional aids designed for librarians and faculty from all institutions. All are printer friendly, available in either html and/or PDF format, and can be downloaded and customized for each institution's needs. As this page matures, guidelines will be developed to catalog information, either by developing institution, by subject area, or a combination of the two. Handouts or Web readings with broad usage generated from the Internet Navigator course materials include those listed below:

- Outline of the Research Process
- Using Reference Tools to Find Background Information
- Using Internet Search Engines to Find Web Sites
- Using Article Databases to Find Articles
- Using Library Catalogs to Find Books
- Creating Search Statements Using Keywords or Controlled Vocabulary
- Introduction to HTML
- Using Boolean Logic and Other Techniques to Enhance Search Statements
- Publishing and Types of Publications
- Critically evaluating information
- Scholarly versus popular information
- Note taking tips
- Documenting sources
- Creating Annotations
- Information ethics for students

In addition, several interactive exercises have been developed that can be used independently of the Navigator course. Most of these are developed with Flash programming and require student interaction to complete. These include:

- Finding Call Numbers
- Citation Builder (APA and MLA)
- Web Site Evaluator

3) **Instruction Web Sites:** The 'Instruction Web Sites' section includes a collection of links on the following topics:

- Information Literacy Competencies
- Web Tutorials
- Copyright and Fair Use
- Library Resources for Distance Learners
- Teaching Tips
- Instructional Technology sites
- Related Professional Associations, Guidelines & Standards
- Assessment Materials & Information
- Teaching & Learning Styles
- Examples of Syllabi for Library Instruction
- Electronic Classrooms
- Basic Library Tutorials
- Assignment Tips & Examples
- UALC Library Instruction Pages

Each topic listed above is divided into three sections: 1) Utah Web sites, from various Utah institutions; 2) association sites, from various associations that deal with areas such as librarianship, education, technology, or instructional design; and 3) an "Other" section, for particularly exceptional sites that do not fit under either of the above categories. Current plans are to limit the number of sites listed to the best 10 to15.

In addition to the collaboratively developed segments of the Internet Navigator course listed above, the *UALC Reference and Information Literacy Committee* has solicited a variety of additional materials to be included on the site from all of the UALC institutions. These include handouts, brochures, database guides,

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and other instructional materials. Some of these materials are institution specific, but are included as useful models. Although most are in HTML, those meant primarily as print publications are included as Adobe PDF files accessed via the Web site.

The suggestion form provides a means for the public to make suggestions about the Internet Navigator course. Improvements to the course result in improvements to the handouts, exercises, etc. appearing in the Faculty Web Site. While the form does not require the person to identify him or herself, it provides that option if one desires a response. The maintenance team typically addresses and replies to all suggestions in their meetings, which occur on a monthly basis.

Most items, with the exception of the password protected "Instructors Pages", are publicly accessible and may be copied, printed, downloaded and customized to meet the needs of any particular individual, class, course, or institution.

Funding Issues:

Funding for the development and ongoing maintenance of the UALC Faculty Resource Web Site is provided cooperatively by UALC. Each library contributes to the annual UALC budget. Each member of the Internet Navigator maintenance team receives a stipend for their work maintaining the course and the Faculty Resource Web site. The maintenance team's annual budget also includes some funding for graphic design and programming which is contracted as needed.

Future Plans:

This Web based collection of resources will continue to grow and expand as more quality materials are added. Future plans may include the development of more interactive tutorials using dynamic Web programming, a searchable interface, more extensive development policies and guidelines, usage statistics, publication of assessment data and other studies done on the UALC Internet Navigator course and this Web site.

Conclusion:

Information literacy instruction in Utah is becoming more similar across institutional boundaries as we continue to purchase more shared online databases and as students access other shared resources such as online article delivery and full text journals. As electronic resources and instructional pedagogies change, each institution spends much time and effort designing new learning resources and updating existing ones. Because Utah libraries share so many of these resources, there is also quite a bit of duplication. Utah is fortunate to have a history of cooperative programs linking librarians and library faculty. Sharing instruction materials statewide via the Web is a natural and cost effective outcome of UALC's ongoing cooperative efforts. The UALC Faculty Resource Web site will serve as a central location for updated versions of electronic resource guides, offer variations in teaching and learning strategies, and serve as a center for new instructional ideas. In addition, institute-specific information may be posted as a model for others. These materials will continue to improve and expand as more inter-institutional Web based sharing occurs. This site enhances support for information literacy competency across the state and region.

Live Online in Andalusia – Bridging the Cultural Gap as East Re-Meets West

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Despite the hyperbole we hear about the Information Superhighway, one thing is clear: traditional University-centered education is merging insanely fast with communication technologies of the 21st Century. Worldwide, students and faculty are faced with new opportunities as well as new challenges in the way programs are presented and received, especially for distance learning and remote education curricula. National and cultural boundaries are melting in the face of increasingly inexpensive technology and bandwidth and a desire for world-class educational opportunities. As Chairman of the Department of Design at the American University of Sharjah in the United Arab Emirates, I have developed a model for distance learning that empowers students from the Gulf Region and beyond to participate in a global dialog, while furthering their educational goals. Using the ultimate in synchronicity – live-online Web-enabled classes – our Multimedia Design and Visual Communication programs are now accessible to the best and brightest minds without regard to geopolitical constraints. In countries thought of in the West as Third World and culturally repressive, yet who's wealth and prosperity have allowed the development of the most up-to-date of telecommunications infrastructures, essential lines of colloquy are re-opening for the first time in centuries between students as East re-meets West.

Knowledge Management and Access in a Multi-Campus System: Collaboration, Communication, and Innovation

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Abstract: The purpose of this paper is to share knowledge management strategies used at the University of Central Florida to provide convenient access to high quality, upper division and graduate level programs in central Florida. The discussion begins with an overview of the expanding University/Community College partnerships. Next, the paper offers a very brief overview of knowledge management and the value of organizational knowledge within an area campus system. Last, the paper examines academic access needs, related to admissions, schedules and registration. The goal of the paper is to demonstrate how the University is combining collaborative alliances, technology, and knowledge management to cost effectively and conveniently respond to economic and educational need across the central Florida area.

Expansion of University/Community College Collaborations

The University of Central Florida is a multi-campus, metropolitan research university that has developed rapidly by working collaboratively with its diverse surrounding communities and expanding populations, technological corridors, and international partners. With a population of more than 34,000 students, UCF is expected to grow to one of the nation's five or six largest universities. In order to manage this rapid growth in enrollment, the university has expanded its 2+2 university/community college partnerships from two existing sites to planning for more than a dozen locations, in keeping with the report for joint-use facilities (Postsecondary Education Planning Commission, 1999). With this expansion, UCF will deliver affordable, convenient, high quality programs across an eleven county service area. See map at: http://pegasus.cc.ucf.edu/~irps/factbooks/1997-2000/county.html .

Knowledge Management Principles

Knowledge management (KM) is a process that promotes an integrated approach to identifying, managing and sharing an organization's information assets, including databases, forms, policies and procedures, as well as the unarticulated expertise and experience resident in individual staff members. Many definitions of KM exist in the literature. For the purpose of this paper, we modified the MITRE definition to read: strategies employed to foster innovation, knowledge transfer, improved service processes, and enhanced learning (Gravellese, 2000). Simply put, KM moves organizations from information access and relay activities to knowledge environments designed to build and enhance learning communities. With KM, organizations establish not only sophisticated electronic systems and technologies; they nurture an institutional culture and approach that supports the open sharing and re-use of information.

Why KM?

At UCF, we are committed to building alliances with education and economic development partners and to providing convenient access to quality higher education in the central Florida region. From the moment they express an interest in an institution, until the day they frame and hang their diploma, students are a part of the structure and culture of the university. As they navigate through unfamiliar academic terrain, outside as well as inside the classroom, we assist them with well-organized and managed networks of resources to enable them to effectively achieve their academic goals. Many of our students reside outside the Orlando metropolitan area in communities where they maintain employment and families. Their nontraditional student character brings a need to remain in their local community to earn career-enhancing credentials. In addition, our non-Orlando students share with their downtown colleagues a consumer view of education firmly rooted in service and access consistent across the university system. Knowledge management affords students in outlying areas direct access to UCF's academic culture, technology and information from the comfort of their homes. A large part of our commitment to high quality education rests on developing technological tools and staff training to provide such access.

Access Needs: Admission, Schedules, Polaris

At UCF's home page, www.ucf.edu, a student can, through the Office of Undergraduate Admissions, access the Office of Transfer Admissions, often most appropriate to nontraditional students holding local community college associate's degrees. From there, the Office of Transfer Services and the State University System application are only a hot link away. Notably, the designers of the pages used a great deal of knowledge management skill to bring information, technology, and academic culture together, and to present it in a user-friendly format. Many pages include photos of staff members and convenient jump access to a major field of study for transfer tips and checklists, as well as major-specific admission and degree requirements.

With few exceptions, UCF's online schedule page, http://classschedule.ucf.edu/, presents a learning product designed to share vast amounts of information in a format that allows users to limit searches by department, course, status (open or closed), academic level, and location or branch. Telephone and email contact, at each campus affords failsafe access for the most tyro user. All university staff, particularly those in computer laboratories, the library, and college offices, can assist students in accomplishing their registration goals. Once a course of study is selected, the student is ready to register online using the POLARIS system.

The Personal On-Line Access to Restricted Information Systems—POLARIS—is the University's gateway to personal information at http://polaris.ucf.edu/ . The greatest area of shared information on POLARIS is targeted to students and allows access to registration, financial aid information, and grades. In addition, a large highlighted prompt area contains important current information relative to schedule postings, registration, and withdrawal deadline dates. Polaris access is essential since the University no longer mails fee invoices or grades. System demonstrations are included in each campus transfer student orientation session. For area campus students, mandatory group orientation sessions at campus sites, however, require taking time away from work or families to attend the half-day sessions. Web-based orientation sessions at http://reach.ucf.edu/~vorient/instructions.html ensure anytime, anywhere access to orientation.

Conclusion

The focus of this paper has been on the effective use of partnerships and managed knowledge, staff expertise and networks of resources to enable students to use online admission, schedules, and registration systems in nearby and remote areas to achieve their academic and career goals as UCF presence expands in the central Florida area.

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Creating a learning environment on the Internet

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Abstract: The article present how net-based learning and the Internet is used to develop a project based learning environment. The presentation will be based on the interesting results from the work at the Norwegian University of Technology and Science (NTNU). We'll look at some of the main principles of learning theory before we move on to the structuring of virtual learning environments and presents the tools for developing entirely net-based learning environments, where the resources in the network work together to support the project based learning process. Last, we'll take a closer look at the results from the work at NTNU on project based learning.

Background

The universities are being criticised for creating passive students and for teacher managed methods, based on old behavioristic learning theories. When Information- and Communication Technology (ICT) now makes it's entry, there is a risk that teacher managed models will be copied into network-based learning. The last few years, The Norwegian University of Technology and Science (NTNU) in collaboration with other universities/colleges and companies, both nationally and internationally, has been working actively towards the development of a more flexible, problem- and project based learning, in which network-based learning in Internet creates the foundation. Constructivistic learning-theory and situated learning, have formed the pedagogical background, not least in order to be capable of offering flexible learning possibilities when it comes to lifelong learning and the need for continuing vocational training in trade and industry.

Learningtheoretical platform

When it comes to the learning theoretical aspect I've been working from an hypothesis saying that the learner is the one who is active and hardworking. That is, it is not enough being passive during lectures and then make an all-out effort before the exam, or possibly now and then. Thus, it was for me very important to create a scheme where not only the naked facts are emphasized, which in turn are reproduced at the exam, but also that one should become productive and creative from working with the course material.

Today we say that we have an enlightened society where new information is very easily accessible and where it is expected that we keep our knowledge updated. It's not enough to only learn the naked facts but also that we learn to find our way faster and faster through a constantly changing knowledge environment. If not, our knowledge will become "reduced" in relation to the world around us. It is not the fact the we forget that creates this reduction but rather the amount of information. However, there are also professions that change at a similar paste.

The process of learning is therefore a part of a much bigger context than just learning the facts from a course material. The learning process is connected to both the facts that we're supposed to learn and to the context in which the knowledge is to be used.
The way a teacher, the learning process, acts has become very significant. Having a practiced learning process makes it much easier to explore a changing knowledge environment at a later point. A process which creates the foundation of lifelong learning.

We are now living in a time of change where we're about to move from broadcasted education to interactive learning (Tapscot, 1998). Ordinary lectures are classified under broadcasting, not least when it comes to big lectures. This is not case with interactive media. Eric Edvards Vogt (Vogt, 1995) represents the different elements of a good learning process as a DNA-model. As we know, DNA are the high-molecular connections that create the genetic information which in turn controls the processes of all living organisms. The DNA-model reminds us that in reality all learning results from a combination and re-combination of different types of learning activities.

Coaching. Can contain lections, coaching when choosing exercises, give hints, simplifying complexity, evaluating activities and diagnosing problems. However, it also includes training of the student's ability to observe and to ask questions. Learning how to ask questions is in many contexts just as important as solving exercises. By asking questions, wondering, one learns how to seek knowledge. You become hungry for knowledge.

Team learning. Through this kind of activity one learns to establish confidence and to cooperate, how to ask motivating questions and how to participate in a creative process by using dialogues. In a good learning environment a person will acquire two kinds of knowledge. The first one implies acquiring the concrete knowledge demanded by the exercise. The second one implies functioning as a learning individual within the environment, having the ability to fit in with other people and taking joint responsibility. The knowledge of a well-functioning group is bigger than the total amount of knowledge from individuals (Edvin Hutchins, "Cognition in the wild", 1996). This is especially emphasized by the researchers of situated learning. Resnick (Resnick, 1998) stresses the fact that most their lives human beings *learn* and *work* together and not individually, as it often is at school.

Most people have experienced the joy of being a part of a well-functioning group – where the members trust each other, where they complement each others strong sides and compensate for the weak ones, having common goals which are bigger than the individual's goals, and where teamwork gives excellent results.

Desktop learning is the expression that Vogt uses for representing learning when using interactive media, hypermedia – multimedia. Using such media is supposed to support various teaching styles and engaging the students in being active in the learning process. For example, it is possible to seek information by using completely different possibilities than what has been possible in traditional education. By using desktop learning it becomes possible to both read, write, listen and talk.

It is possible to adjust the DNA-model to different types of learning. Central types of learning are *learning by discovery, problem-based learning* and *project-based learning*. All of these types of learning are closely related and fall under the heading *active learning*. *Learning by discovery* follows a learning process which is based upon abstraction, experimenting, observation and reflection. This forms part of a loop, a discovery loop. The tutor abstracts the material, gives exercises, etc. and the students follows up by using desktop learning. It is important that the students learn to articulate and presenting their reflections.

The learning environment

The learning environment consisted of a homepage with miscellaneous information and access to services, such as the hyper-system and the oracle service. Traditional lectures were often recorded on video and synchronized with topical material in the multimedium/hyper-system. This way, it became possible to listen to lectures and repeat at a suitable moment. Compared to the DNA-model, the lectures are part of the coaching part in the DNA-model and in the presentation-area in virtual learning environment. There was a workbook attached to the course, and here the students were supposed to present their own and their group's reflections of the lectured material.

A hyper-system (a multimedia system) on the internet was created for the course, and also a workbook was made. Most of the written material in the hyper-system was duplicated and added to the workbook as a compendium. A part of the material existed only in the hyper-system, i.a. this was the case for animations which use the dynamics of the computer and therefore badly suited for duplication on paper and for the video-lectures.

As group-tool, Teamwave was chosen. Teamwave is an integrated groupware-solution for several platforms (MS-Windows, UNIX and Macintosh) which enables flexible coordination, cooperation and sharing information on the

Internet. It is possible to cooperate in real-time (synchronized) combined with the possibility of storing information and messages, which allow the participants to work at different times (asynchronized).

The obligatory exercise arrangement was connected to project-based learning where the use of groups was required. Theory on group work was apportioned and the work-method was presented by the student assistants. The obligatory work related to the lectures, the single exercises, the workbook and the project together counted for 50% of the final course-grade. It was important to keep the given deadlines

Structuring a virtual competence environment

Based on these learning theoretical principles, we have tried to see how available services on the Internet can be structured and used in order to promote a learning environment with active actors genuinely collaborating in a total context. The resources/services that are available in a virtual competence network can be structured in relation to tasks and activities to be emphasised. We have chosen to structure the services into five areas, according to which tasks/theories that are to be dealt with: A presentation-arena for presenting and receiving scientific literature/theories, a knowledge arena for accessing library services/on-line services and other accumulated knowledge, a working arena to manage collected material/information and produce new material, a private arena to make personal notes and reflections, and last a communication arena which, together with the working arena, make up the main core of a learning process based on constructivism and situated learning.

Presentation-/lecture area

The criticism against behavioristic learning theory is especially directed towards the belief that «someone can teach someone something» and that learning can be managed by the teacher. Thus, the possibility of spreading huge amounts of science material in a simple and flexible way by using network-based systems, shouldn't be confused with learning. Science material can be presented and mixed together via network-based systems through different kinds of media, such as text, drawings, pictures, animation, video, and audio. It all depends on the one(s) having the knowledge how this knowledge can be made available to others. The activities related to this arena are on one side to present information and on the other side to receive information. And, vice versa, if the communicating parts are equal. Based on cognitivistic principles, this arena will be important if the material is organised properly. How great the activity related to this arena will be, depends on the amount of information to be mediated. For example, there will be relatively much more activity on this arena if the system is being used in relation to a defined material/course (reproducive learning), than in relation to creation, e.g related to learning organisations.

Competence area for accessing library services and other accumulated knowledge

This area is also an information area. However, it's main emphasis is to actively search for information/answers for the topical questions. Thus, accessing databases and libraries will be in the form of searching in relation to accumulated and stored information, while requests made to an oracle service may either be contact with resource persons and/or with accumulated information, e.g. stored answers in «Frequently Asked Questions» (FAQ). The services in both the presentation area and the knowledge area must first of all be seen as resources in relation to the actors learning process.

Working area for organising and producing science material

Area for personal organising of material. This is the real learning area, if based on constructivistic learning theory. The learning take place through the actors treatment of information and production of new material. The tools available in this arena are the same as those in the presentation/lecture arena, but now as tools for organising and producing your own material. Group-ware tools are included also here in relation to personal work but communication with others is done in the communication arena. The workbook is also here when working with personal material but the storage of this one is in the private arena.

Private area for personal notes and reflections and Communication area for interaction and collaboration

Basically, the private arena is supposed to be used for storing personal material. The private workbook is stored here. Area for communication and organising in relation to others. Together with the working arena, this is the most important learning arena if based on situated learning. Here, together with group-ware tools, e-mail and the World Wide Web (WWW) create the communicative foundation.

Tools and help services to realise Learning Environments in Internet - Interactive learning system, (ILS)

In order to realise this new network-based learning environment it has been necessary to develop a number of tools and help services in order to increase the smoothness of the layout and the production of network-based scientific literature, and support for the learning co-operation. This tools consist of an infrastructure tool based on the Internet and includes tools for hyper-/multimedia-systems, video on demand, animation, object-orientated design based on constructivistic learning principles, info-search in free text, a knowledge test based on free text, an oracle-/help service, a workbook, and a plan for student administration. We have also developed specifications for necessary services in group-ware, but this tool is not realised yet.

The Infrastructure tool creates the complete frame for the learning area and ties the areas/functions together. Consequently, the areas are able to communicate and use the resources across the borders.

The tool for creating *Hyper-/multimediasystem on Internet* make it possible to use media such as video, navigation, lecture-paths, personal paths, lectures on video synchronised with information in the hyper-system, and the possibility of making personal notes for each node, personal working arena, choosing language, fonts, colours, background, etc.

The Video on demand tool edits video (e.g. a lecture) and makes it possible to synchronise events in order to find the desired picture/sequence. By using this tool it also becomes possible to edit overheads and animations in relation to a video sequence. This is useful if one wants to use several media in order to strengthen a message.

The Animation tool makes it possible to create animations which doesn't demand much band-with. It is also possible to control the animations step-by-step from a video-lecture. For example, this may be desirable if one wants to illustrate a process and explain what's going on simultaneously.

The Object-oriented design tool makes it possible for a teacher or a student to build a set of objects by using their own knowledge about a subject. Based on the objects one may easily construct systems in which the system and the work progress are visualised and animated during the execution.

By use of *the tool for Info-search in free text* one may search for information in free text; the information and the search are compared by use of vectors. Nonsense-answers can be rejected, answers with a touch of reason can be guided. Here, the teacher can decide where to draw the line between nonsense and reason.

The Oracle service/help service tool structures and creates a connection with an on-line help service. Questions and answers are stored for later use in an automatic service for «Frequently Asked Questions».

The Digital workbook structure tool gives possibility to make sure that learning is done through one's own activity and production, activities in an electronic workbook are very important. The workbook is a frame into which the users are supposed to put their own product, and not a book where you fill in the correct answers, or where you practice defined tasks. This workbook is also available to course administrators/tutors in the period of study, so that course-related discussions are connected to the work of the learner and which they show through the product that the workbook will become. It is also possible to share and develop a workbook in collaboration with other students/partners. Connected to the workbook, there are tools for editing, asking for help and possibilities for tutor/colleges to add comments. It is possible to divide the workbook into chapters. Which tasks that are connected to each chapter will depend on whether there is a special course to be completed or whether

the workbook is being used as a public domain for documenting the work in progress. If the workbook is to be used in connection to a specific course content, it is up to the course administrator and those participating how to proceed. One example of how to structure the workbook:
Preface, where the participant presents himself/herself.

- A chapter where a group of persons, single or together, creates an overhead series in order to present a part of the material to each other. That is, the participants function as «teachers» for the rest of the group. They do this in turn so that everyone gets the opportunity to present course material to the others in the group.
- A chapter for writing a summary of lectures/presented material.
- A chapter for practicing exercises. These are solved through discussions and by working in groups.
- A chapter for a project assignment.
- A chapter for miscellaneous.

From a learning theoretical perspective, based on active creative actors in genuine collaboration, we think that the working area and the collaboration area, can create the foundation for such an active collaborative learning process, while the presentation area and the knowledge area can be considered more as resources for the actors work and production. A well-designed network-based learning environment can, as we see it, create the foundation for active, creative collaborative learning.

Project based learning and integration of net-based learning at NTNU

The last few years we've been trying to integrate ICT more and more into the learning process, at the same time as the number of students attending the computer science classes is ten times higher than five years ago. Autumn 1999 we decided to go all the way for one of the courses and make a shift from traditional teaching to project based learning based upon net-based learning.
256 students joined the course called MNFIT 222. The course is a 3-credit course (20 credits = one year full study time) at a graduated level within the computer and information scienceses-area. 20 of these students attended the old traditional program, while the rest of the students followed a project based model. However, despite the fact that we used project based learning, the aim was not to use a model where the student is supposed to decide how to proceed on his/her own. From experience we know that most students wants to study within an organised structure. And this is what we tried to organise, at the same time as we tried to emphasise the main principles of constuctivistic/situated learning process.

Results

Most of the groups and the students produced a quite impressive work. The produced material showed hard work on both the individual parts and the team parts. Each student produced material, which amounts to 50 to 70 A4-pages. Each workbook was evaluated with equal emphasis on both the group- and the individual work. There was also an evaluation of the keeping of deadlines. The evaluation of the workbook made up 50% of the final grade. In addition, there was, to a certain degree, an evaluation of how the groups functioned as groups and of how each member functioned within the group. The result from this evaluation did not count when setting the final grade but was used for studying group-work features.
Many of the students got a higher grade on the workbook than on the exam; some even got a significantly higher grade. However, some got a better grade on the exam than on the workbook. It seems that the latter didn't put to much effort into the workbook and the groups to which they belonged didn't function too well.
Analysis of the grades for workbooks compared to exam grades shows low correlation (0.2 – 0.3). Also when using a chi-square analysis one gets similar results. If we set up a hypothesis saying that the exam grade is supposed to be somewhere within a given distribution from the means between the grades on the workbook and the exam grades, it will show that the result is not within a 5% level. This means that the observations deviate from what's considered to be "reasonably normal".
It is obvious, at least for MNFIT222, that there are other qualities than those traditionally measured at exams that are emphasised in the project work. However, this doesn't mean that these former qualities aren't as good and important as the latter, rather quite the contrary.

The exam in MNFIT222 was given as a traditional exam where memory and finding quick logical solutions are strongly emphasised. One should notice that even though the correlation was low, the results on the exam were significantly improved. An improvement of 0.7 points for the average grade, and the same in the median, must be considered as highly significant. So, it has actually been possible to get 'the best out of both worlds', i.e. both good 'work results' and good traditional exam results.
The question is: Could we manage without the exam and just stick to the 'work-grade'?
It should also be mentioned that there were a few complaints on the new program, especially at the beginning. The critics argued that writing belongs to first language classes at high school. The students weren't used to combining various subjects, i.e. bringing knowledge from one subject to another. They weren't used to considering writing and written material as a part of a learning process. After a while the mentioned criticism ceased. When discussing the course program at the end of the course during one of the parallel lectures, someone criticised the course for being far too demanding when considering the number of points one obtained. This claim wasn't accepted by others who felt that the course wasn't more complex than the number of hours one should expect to be used at a 3-credits course per week.
During this discussion it was also mentioned that the demanding part was when one postponed the assignments and then trying to make an all-out effort at the end of the course.
Both near the end of the course and after the course, we received a lot of feedback on the project, almost exclusively positive.
A comparison between the exam results from 1996 to 2000, shows that the group following the new program autumn 1999 and autumn 2000, achieved much better results than earlier. For 1999 the failure percentage is only 4.2%, the average grade is 2.5. For 2000 the failure percentage is 0 %, the average grade 2.5. With the traditional program for 1998 the failure percentage was 16% and the average grade was 3.2. (1.0 is best and 6.0 weakest).

Compared to the traditional program in 1999/2000 and earlier, it must be allowed to mention that the new program 'worked'. Not least when knowing that the resources for assignment work were heavily reduced compared to previous years. The median is at 2.4; showing that the majority of students have results that are better than the average.
For those 20 students in 1999 and 18 in 2000, who followed the traditional program the result is quite the opposite: The median is considerably weaker than the average grade. Average for this students was in 1999 2.9 and the same in 2000. This means that the results for those students are clustering around much weaker results than the average.
If we take a look at the final average grade for those who followed the new program, we find that it is 2.3 for 1999 and 2.2 for 2000 compared to 3.2 for 1998. As mentioned earlier, here, the assignment work is included. Both individual work and group work are included in the assignment work.

Conclutions

Based on constructivism and sociocultural approaches we have tried to arrange for a internet-based learning environment that supports project based learning and active, creative actors in genuine collaboration. We have up to now gained some experiences and interesting results in this area by developing tools and net-based learning environments to support project based learning and group collaboration. There is still a lot of work to be done, both on integration of ICT in project based learning and on the development of tools and learning environments.

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Student interaction patterns in electronic conferences

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This is a research report of a study which examined sustained interaction, as focused interaction, in two conference systems to determine if a conference system, as media, influences the structure of discourse interaction. The conference systems used were WebBoard Conference© (a Web-based bulletin board) and eGroups (ListServ program) without student Web interface access. Although the research questions were written in a form to facilitate quantifiable variables, the main issue was does the conference system matter in respect to the communication which occurs within. The discourse structures considered in this study include the use of referring, indirect address and direct address. Referencing indicates what was read, what is to be considered as a frame for interpretation or context and a sense of audience. This study is currently in progress. The results will be available the end of March 2001. The research findings should assist decision makers selection of conference systems. The findings are expected to provide evidence that the design of the conference system matters. A pragmatic contribution from this study is in its application to instructional design decisions when integrating computer-conferencing into educational environments.

eLearning based on the Semantic Web

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Abstract: eLearning is efficient, task relevant and just-in-time learning grown from the learning-requirements of the new, dynamically changing, distributed business world. The term „Semantic Web" encompasses efforts to build a new WWW architecture that enhances content with formal semantics, which enables better possibilities for navigating through the cyberspace and accessing its contents. As such, the Semantic Web represents a promising technology for realizing eLearning requirements.
This paper presents an approach for implementing the eLearning scenario using Semantic Web technologies. It is primarily based on ontology-based descriptions of content, context and structure of the learning materials and thus provides flexible and personalized access to these learning materials.

Introduction

It is clear that new styles of learning are some of the next challenges for every industry. Learning is a critical support mechanism for organizations to enhance the skills of their employees and thus the overall competitiveness in the new economy (Drucker 2000). The incredible velocity and volatility of today's markets require just-in-time methods for supporting the need-to-know of employees, partners and distribution paths. It is also clear that this new style of learning will be driven by the requirements of the new economy: efficiency, just-in-time delivery and task relevance.

Time, or the lack of it, is the reason given by most businesses for failing to invest into learning. Therefore, learning processes need to be efficient and just-in-time. Speed requires not only a suitable content of the learning material (highly specified, not too general), but also a powerful mechanism for organizing such material. Also, learning must be a customized on-line service, initiated by user profiles and business demands. In addition, it must be integrated into day-to-day work patterns and needs to represent a clear competitive edge for the business. Learning needs to be relevant to the (semantic) context of the business (Adelsberger et al. 2001).

eLearning aims at replacing old-fashioned time/place/content predetermined learning with a just-in-time/at-work-place/customized/on-demand process of learning. It builds on several pillars, viz. management, culture and IT (Maurer&Sapper 2001). eLearning needs management support in order to define a vision and plan for learning and to integrate learning into daily work. It requires changes in organizational behavior establishing a culture of "learn in the morning, do in the afternoon". Thus, an IT platform, which enables efficient implementation of such a learning infrastructure, is also needed. Our focus here lies on IT (Web) technology that enables efficient, just-in-time and relevant learning. Current Web based solutions don't meet the above mentioned requirements. Some pitfalls are e.g. information overload, lack of accurate information or content that is not machine-understandable.

The new generation of the Web, the so-called Semantic Web, appears as a promising technology for implementing eLearning. The Semantic Web constitutes an environment in which human and machine agents will communicate on a semantic basis (Berners-Lee 2000). One of its primary characteristics, viz. shared understanding, is based on ontologies as its key backbone. Ontologies enable the organization of learning materials around small pieces of semantically annotated (enriched) learning objects (Neidl 2001). Items can be easily organized into customized learning courses and delivered on demand to the user, according to her/his profile and business needs .

The paper will outline how the Semantic Web can be used as a technology for realizing sophisticated eLearning scenarios. In the following, we will first sketch requirements for eLearning. Thereafter, we analyze the representational structures that are offered by the Semantic Web (common semantics, machine-processable and -understandable data) and discuss layers of the Semantic Web architecture. In the subsequent section, the advantages of using ontologies for describing eLearning materials are presented. We continue with a description of an ontology-based approach for eLearning. After a discussion of related work, concluding remarks summarize the importance of the presented topics and outline some future work.

eLearning and eLearning requirements

"eLearning is just-in-time education integrated with high velocity value chains. It is the delivery of individualized, comprehensive, dynamic learning content in real time, aiding the development of communities of knowledge, linking learners and practitioners with experts" (Drucker 2000).

Standard or traditional learning processes can be characterised by centralised authority (content is selected by the educator), strong push delivery (instructors push knowledge to students), lack of a personalisation (content must satisfy the needs of many) and the linear/static learning process (unchanged content). A detailed view on standard learning is given in Tab.1. However, such an organisation of the learning process results in an expensive, slow and too unfocused (problem-independent) learning process. Dynamically changing business environments put completely different challenges on the learning process - it has to be efficient, just-in-time and task relevant (problem-dependent), as mentioned in first section. This can be solved with eLearning, i.e. with a distributed, student-oriented, personalised, and non-linear/dynamic learning process. Tab. 1 shows the characteristics (or pitfalls) of the standard learning scenario and the improvements achieved using the eLearning approach. These are also the most important characteristics of eLearning.

Dimensions	Training	eLearning
Delivery	Push – Instructor determines agenda	Pull – Student determines agenda
Responsiveness	Anticipatory – Assumes to know the problem	Reactionary – Responds to problem at hand
Access	Linear – Has defined progression of knowledge	Non-linear – Allows direct access to knowledge in whatever sequence makes sense to the situation at hand
Symmetry	Asymmetric – Training occurs as a separate activity	Symmetric – Learning occurs as an integrated activity
Modality	Discrete – Training takes place in dedicated chunks with defined starts and stops	Continuous – Learning runs in the parallel to business tasks and never stops
Authority	Centralized – Content is selected from a library of materials developed by the educator	Distributed – Content comes from the interaction of the participants and the educators
Personalization	Mass produced – Content must satisfy the needs of many	Personalized – Content is determined by the individual user's needs and aims to satisfy the needs of every user
Adaptivity	Static – Content and organization/taxonomy remains in their originally authored form without regard to environmental changes	Dynamic – Content changes constantly through user input, experiences, new practices, business rules and heuristics

Table 1 Differences between training and eLearning (Drucker 2000)

The principle behind eLearning is that the tools and knowledge needed to perform work are moved to the workers – wherever and whoever they are. Simply put, eLearning revolves around people. This is in stark contrast to the way learning has typically involved people flocking around the learning, i.e. a typical scholastic environment.

eLearning has its origins in computer-based training (CBT), which was an attempt to automate education, replace a paid instructor, and develop self-paced learning. But, the focus of eLearning extends and improves the CBT scenario by a learning approach that removes the barriers of time and distance, and customizes learning to the user's and business' needs (Barker 2000). Key to success is the ability to reduce the cycle time for learning and to adapt "content, size and style" of learning to the respective user and its business environment.

Semantic Web architecture - XML, RDF and Ontologies

The term „Semantic Web" encompasses efforts to build a new WWW architecture that enhances content with formal semantics. That means, content is made suitable for machine consumption, as opposed to content that is only intended for human consumption. This will enable automated agents to reason about Web content, and produce an intelligent response to unforeseen situations.

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Layers of the Semantic Web

"Expressing meaning" is the main task of the Semantic Web. In order to achieve that objective several layers of representational structures are needed. They are presented in the figure 1 (Berners-Lee 2000), among which the following layers are the basic ones:

- the XML layer, which represents the structure of data;
- the RDF layer, which represents the meaning of data;
- the Ontology layer, which represents the formal common agreement about meaning of data;
- the Logic layer, which enables intelligent reasoning with meaningful data.

It is worth to note that the real power of the Semantic Web will be realized when people create many systems that collect Web content from diverse sources, process the information and exchange the results with other human or machine agents. Thereby, the effectiveness of the Semantic Web will increase drastically as more machine-readable Web content and automated services (including other agents) become available. This level of inter-agent communication will require the exchange of "proofs".

Two important technologies for developing the Semantic Web are already in place: the eXtensible Markup Language (XML) and the Resource Description Framework (RDF).

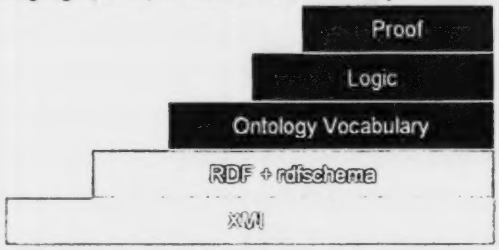

Figure 1 Layers of the Semantic Web architecture

XML (http://www.w3.org/XML/) lets everyone create its own tags that annotate Web pages or sections of text on a page. Programs can make use of these tags in sophisticated ways, but the programmer has to know what the page writer uses each tag for. In short, XML allows users to add arbitrary structure to their documents but says nothing about what the structures mean (Erdmann & Studer 2000). Meaning of XML-documents is intuitively clear, due to "semantic" mark-up and tags, which are domain-terms. However, computers do not have intuition. Tag-names per se do not provide semantics.

Data Type Definitions (DTDs) are a possibility to structure the content of the documents. However, structure and semantics are not always aligned, they can be orthogonal. Therefore, a DTD is not an appropriate formalism to describe the semantics of an XML document.. The same holds for XML-Schema (http://www.w3.org/XML/Schema) – it only defines structure, though with a richer language. In essence, XML lacks a semantic model: it has only a "surface model", a tree. So, XML is not the solution for propagating semantics through the Semantic Web. It can only play the role of a "transport mechanism", viz. as an easily machine-processable data format.

The Resource Description Framework (RDF) (http://www.xml.com/xml/pub/98/06/rdf.html) provides a means for adding semantics to a document. RDF is an infrastructure that enables encoding, exchange and reuse of structured metadata (described later). Principally, information is stored in the form of RDF statements, which are machine understandable. Search engines, intelligent agents, information broker, browsers and human users can understand and use that semantic information. RDF is implementation independent and may be serialized in XML (i.e., its syntax is defined in XML). A process in which semantic information is added to the web documents is called semantic annotation (Handschuh et al. 2001). RDF, in combination with RDFS (http://www.w3.org/TR/PR-rdf-schema/), offers modeling primitives that can be extended according to the needs at hand. Basic class hierarchies and relations between classes and objects are expressible in RDFS. In general, RDF(S) suffers from a lack of formal semantics for its modeling primitives, making interpretation of how to use them properly an error-prone process.

A solution to this problem is provided by the third basic component of the Semantic Web, viz. ontologies. In philosophy, an ontology is a theory about the nature of existence, about what types of things exist; ontology as a discipline studies such theories. Artificial Intelligence and Web researchers have co-opted the term for their own jargon, and for them an ontology describes a formal, shared conceptualization of a particular domain of interest.

Ontologies are specifications of the conceptualization and corresponding vocabulary used to describe a domain (Gruber 1993). They are well-suited for describing heterogeneous, distributed and semistructured information sources that can be found on the Web. By defining shared and common domain theories, ontologies help both people and machines to communicate concisely, supporting the exchange of semantics and not only syntax. It is therefore important that any semantic for the Web is based on an explicitly specified ontology. By this way consumer and producer agents (which are assumed for the Semantic Web) can reach a shared understanding by exchanging ontologies that provide the vocabulary needed for discussion.

Ontologies typically consist of definitions of concepts relevant for the domain, their relations, and axioms about these concepts and relationships. Several representation languages and systems are defined. A recent proposal

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extending RDF and RDF Schema is OIL (Ontology Interchange Language) (Fensel et al. 2001). OIL unifies the epistemologically rich modeling primitives of frames, the formal semantics and efficient reasoning support of description logics and mapping to the standard Web metadata language proposals. The DAML+OIL language (http://www.daml.org/2001/03/reference.html) has also been developed as an extension to XML and RDF. It heavily relies on OIL and is a similar representation language for describing web resources and supporting inference over those resources.

Semantic Web & eLearning

The key property of the Semantic Web architecture i.e. (common-shared-meaning and machine-processable metadata), enabled by a set of suitable agents, establishes a powerful approach to satisfy the eLearning requirements: efficient, just-in-time and task relevant learning. Learning material is semantically annotated and for a new learning demand it may be easily combined in a new learning course. According to his/her preferences, a user can find and combine useful learning material very easily. The process is based on semantic querying and navigation through learning materials, enabled by the ontological background.

In fact, the Semantic Web can be exploited as a very suitable platform for implementing an eLearning system, because it provides all means for (eLearning): ontology development, ontology-based annotation of learning materials, their composition in learning courses and (pro)active delivery of the learning materials through eLearning portals. More details about the eLearning scenario will be given in the last section. In the following (Tab. 2) a summary view of the possibility to use the Semantic Web for realizing the eLearning requirements is presented.

Requirements	eLearning	Semantic Web
Delivery	Pull – Student determines agenda	Knowledge items (learning materials) are distributed on the web, but they are linked to commonly agreed ontologie(s). This enables construction of a user-specific course, by semantic querying for topics of interest.
Responsiveness	Reactionary – Responds to problem at hand	Software agents on the Semantic Web may use a commonly agreed service language, which enables co-ordination between agents and proactive delivery of learning materials in the context of actual problems. The vision is that each user has his own personalised agent that communicates with other agents.
Access	Non-linear – Allows direct access to knowledge in whatever sequence makes sense to the situation at hand	User can describe the situation at hand (goal of learning, previous knowledge,...) and perform semantic querying for the suitable learning material. The user profile is also accounted for. Access to knowledge can be expanded by semantically defined navigation.
Symmetry	Symmetric – Learning occurs as an integrated activity	The Semantic Web (semantic intranet) offers the potential to become an integration platform for all business processes in an organisation, including learning activities.
Modality	Continuous – Learning runs in parallel to business tasks and never stops	Active delivery of information (based on personalised agents) creates a dynamic learning environment that is integrated in the business processes.
Authority	Distributed – Content comes from the interaction of the participants and the educators	The Semantic Web will be as decentralised as possible. This enables an effective co-operative content management.
Personalization	Personalized – Content is determined by the individual user's needs and aims to satisfy the needs of every user	A user (using its personalised agent) searches for learning material customised for her/his needs. The ontology is the link between user needs and characteristics of the learning material.
Adaptivity	Dynamic – Content changes constantly through user input, experiences, new practices, business rules and heuristics	The Semantic Web enables the use of distributed knowledge provided in various forms, enabled by semantical annotation of content. Distributed nature of the Semantic Web enables continuous improvement of learning materials.

Table 2 Benefits of using Semantic Web as a technology for eLearning

Metadata & eLearning

This section gives an overview of the current metadata standards for eLearning and discusses the problems in shared-understanding, which arise when using these conventional metadata. It outlines the enhancement that is achieved by using an ontology-based solution (ontology-based metadata) applied in our e-Learning scenario (cf. the subsequent section).

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Conventional Metadata for eLearning

Compared to traditional learning in which the instructor plays the intermediate role between the learner and the learning material, the learning scenario in eLearning is completely different: instructors no longer control the delivery of material and learners have a possibility to combine learning material in courses on their own. So the content of learning material must stand on its own. However, regardless of the time or expense put into creating advanced training material the content is useless, unless it can be searched and indexed easily. This is especially true as the volume and types of learning content increase.

One solution lies in using metadata. Metadata is the Internet-age term for information that librarians traditionally have used to classify books and other print documents. At its most basic level, metadata provides a common set of tags that can be applied to any resource, regardless of who created it, what tools they used, or where it's stored. Tags are, in essence, data describing data. Metadata tagging enables organizations to describe, index, and search their resources and this is essential for reusing them.

In the eLearning community three metadata standards are emerging to describe eLearning resources: IEEE LOM (http://ltsc.ieee.org/doc/wg12/LOM3.6.html), ARIADNE (http://ariadne.unil.ch/Metadata/) and IMS (http://www.imsproject.org/metadata/imsmdv1p2/imsmd_infov1p2.html). Those meta-models define how learning materials can be described in an interoperable way. All the metadata elements necessary to describe a resource can be classified into several categories, each offering a distinct view on a resource.

For example, the LOM standard contains the following metadata levels:

- general - groups all context-independent features plus the semantic descriptors for the resource;
- lifecycle - groups the features linked to the lifecycle of the resource;
- meta-metadata - groups the data elements describing the metadata that indexes the document;
- technical - groups data elements describing the technical features of the document;
- educational - groups educational and pedagogic data elements for the resource;
- rights - groups data elements pertaining to the conditions of use for the resource;
- relation - groups data elements that describe the linkage between the subject and other resources;
- annotation - groups data elements that allow comments on the educational use of the resources;
- classification - groups data elements that describe the position of the resource in an existing classification system.

Different communities have developed their own standardized metadata vocabularies to meet their specific needs. However, most of those metadata standards lack a formal semantics. Although these standards enable interoperability within domains, they introduce the problem of incompatibility between disparate and heterogeneous metadata descriptions or schemas across domains.

This lack of a shared understanding between terms in one vocabulary as well as between terms in various metadata vocabularies might be avoided by using ontologies as a conceptual backbone in an eLearning scenario.

Ontology-based metadata

The role of an ontology is to formally describe shared meaning of the used vocabulary (set of symbols). In fact, an ontology constrains the set of possible mapping between symbols and their meanings. But the shared-understanding problem in eLearning occurs on several orthogonal levels, which describe several aspects of document usage, as sketched in Fig. 2.

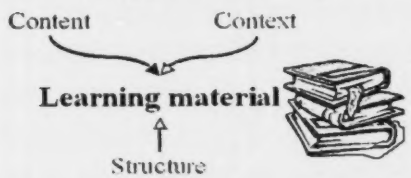

Figure 2 From the student point of view the most important criterions for searching learning materials are: what the learning material is about (content) and in which form this topic is presented (context). However, while learning material does not appear in isolation, another dimension (structure) is needed to encompass a set of learning materials in a learning course.

Metadata for describing the content of learning materials

The shared-understanding problem in eLearning occurs when one tries to define the content of a learning document in the process of providing learning materials as well as in the process of accessing to (searching for) particular learning material.

In an eLearning environment there is a high risk that two authors express the same topic in different ways. This means semantically identical concepts (i.e. topics of eLearning-content) may be expressed by different terms from the domain vocabulary. For example, one may use the following semantically equivalent terms for the concept "Agent": *agent, actor, contributor, creator, player, doer, worker, performer*. The problem can be solved by integrating a domain lexicon in the ontology and thus defining mappings from terms of the domain vocabulary to their meaning as defined by the concepts of the ontology. E.g. in our example *agent, actor, contributor, creator,*

player, doer, worker, performer are symbols used in the real world and they are all mapped to the same concept *Agent* in the domain ontology. Also, in the process of providing information, ontological axioms play an important role. For example, an axiom that states that two relations are mutually inverse relations is used for checking consistency of provided information, as described in the next section.

From the point of view of the user there is the problem of what terms or keywords to use when searching for learning materials. Simple keyword queries are valuable in situations where users have a clear idea of what they are seeking and the information is well-defined. It doesn't hold for eLearning, where the viewpoints and the knowledge levels of the author and the users of learning materials may be completely different. Therefore, some mechanism for establishing shared understanding is needed. Second, simple keyword searches cannot pick up synonyms ("*Agent*" and "*Actor*"), abbreviations ("*World Wide Web*" and "*WWW*"), different languages („*house*" (English) and „*Haus*" (German)) and often not even morphological variations ("*Point-to-Point Network*" and "*Point to Point Network*"), not to mention the context of the query. This problem can be resolved by defining corresponding relations (e.g., synonym, abbreviation) in the domain ontology. Ontological relations are also used in the process of navigating through learning materials (for example, it is reasonable to "jump" from the topic "*Network*" to the topic "*Protocol*").

Metadata for describing the context of learning materials

Learning material can be presented in various learning or presentation contexts. We may e.g. distinguish learning contexts like an *introduction*, an *analysis* of a topic, or a *discussion*. An *example* or a *figure* are some usual presentation contexts. The context description enables context-relevant searching for learning material according to the preferences of the user. For example, if the user needs a more detailed explanation of the topic, it is reasonable to find learning material which describes an example of the given topic. In order to achieve a shared-understanding about the meaning of the context vocabulary (e.g. intro or introduction) a context-ontology is used.

Metadata for describing the structure of learning materials

Because eLearning is often a self-paced environment, training needs to be broken down into small bits of information ("lego" learning) that can be tailored to meet individual skill gaps and delivered as needed. These chunks of knowledge should be connected to each other in order to be able to build up a complete course from these chunks. Learning material is usually more complex in its structure than continuous prose, so it requires greater care in its design and appearance. Much of it will not be read continuously. The structure isn't a static one, because a course structure is configured depending on the user type, the user's knowledge level, his or her preferences and the semantic dependencies that exist between different learning chunks, e.g. an example might depend on first giving the corresponding definiton. But, again shared understanding about used terms is also needed for describing the structure of a learning course.

Several kinds of structuring relations between chunks of learning material may be identified. Some of them are: *Prev*, *Next*, *IsPartOf*, *HasPart*, *References*, *IsReferencedBy*, *IsBasedOn*, *IsBasisFor*, *Requires*, *IsRequiredBy*. There exist semantic connections between some of these relations that may be defined by axioms: for example, *IsPartOf* and *HasPart* are mutually inverse relations. The corresponding axiom may be exploited when searching for information. Without the definition of the inverse relation, searching for information would depend on the way metadata were provided from the author of the learning material. If one defines that some learning material named "*X*" "*IsBasedOn*" some other learning material named "*Y*", there is no possibility (without programming or explicit specification) to find all learning materials the learning material "Y" "*IsBasisFor*".

The reader may note that these three dimensions of metadata also appear in the conventional metadata model (content = classification metadata, context = educational/pedagogical metadata, structure = relational metadata). However, our metadata are ontology-based metadata and have therefore a precisely defined semantics The semantic basis results in a better semantic description of learning materials and better searching for useful materials according to user preferences.

Semantic Web-based eLearning scenario and preliminary experiences

Based on the discussion in the previous section, this section presents an overall architecture of our ontology-based eLearning scenario. The architecture of the system is represented in Fig. 3. The knowledge warehouse acts as a metadata repository and the Ontobroker system (Decker et al. 1999) is an principal inferencing mechanism. Core modules, as depicted in Fig. 3, correspond to primary activities in an eLearning environment:

- providing information from authors
- accessing the learning materials by readers and authors by querying and by browsing.

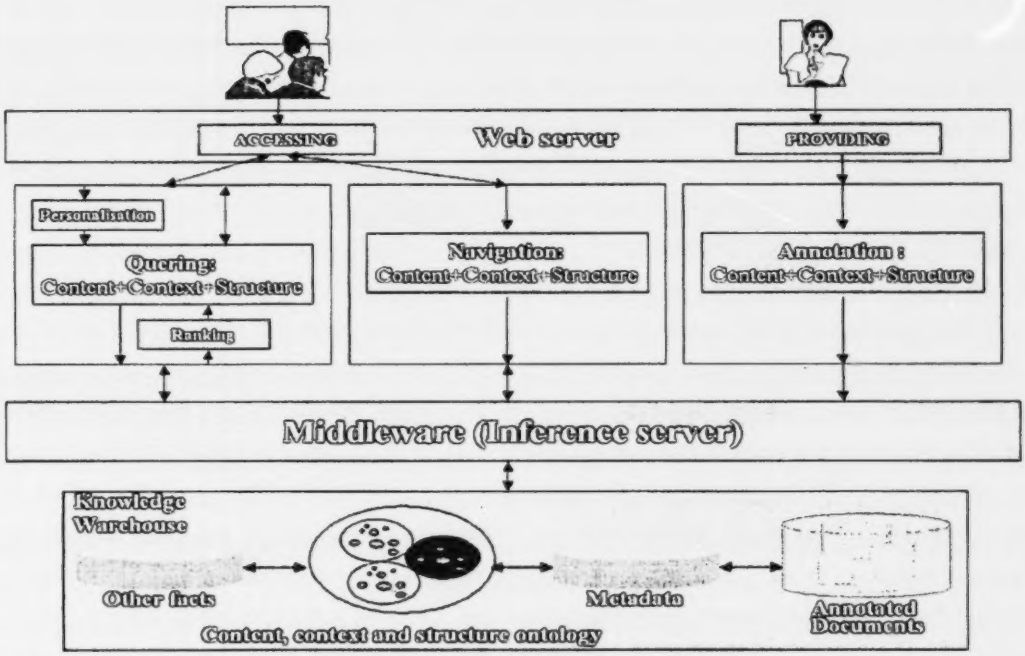

Figure 3 Architecture of an eLearning Portal

Ontology

The backbone of the system is the course ontology presented partially in the Table 3. The ontology definition contains an is-a hierarchy of relevant domain concepts, relations between these concepts, further properties of concepts (attributes with value ranges), and the derivation rules to infer new knowledge. The leftmost column shows the concepts of the domain organized in the is-a hierarchy. For example, "*PhDStudent*" is a subconcept of the concept "*Student*". Attributes and relations of concepts are inherited by subconcepts. Multiple inheritance is supported as a concept may fit into different branches of the taxonomy. Attributes and relations of the concepts appear in the middle column in the Tab. 3. Relations refer to other concepts, like "*hasAuthor*" denoting a relation between the concept "*Document*" and the concept "*Author*". The rightmost column shows some rules of the course ontology. For example, the fourth rule in Tab. 3 asserts that whenever a document D2 is known to have a child document D1 then D2 has D1 as its parent document. This kind of rules completes the knowledge and frees a knowledge provider to provide the same information at different places reducing the development as well as the maintenance efforts. The ontology representation language is F-Logic (Kifer et al. 1995). Roughly, the statements *ConceptX::ParentX* and *ConceptX[relationXY=>>ConceptY]* could be read as *ConceptX* is a subconcept of the concept *ParentX* and *ConceptX* is in the relation *relationXY* with *ConceptY*, respectively.

The course ontology consists of content, context and structure ontology, mentioned in the previous section. The content ontology is visible in the description of domain terms like "*Protocol*", "*Service*", "*Topology*". The relation "*hasTopic*" and the first two rules are also a part of the content ontology. The first rule determines the transitive property of the "*hasTopic*" relation (Maedche et al. 2001). For example, based on the first rule and on the facts that "*eLearning hasTopic TeleTeaching*" and that "*TeleTeaching hasTopic WebBasedLearning*", the fact "*eLearning hasTopic WebBasedLearning*" is concluded (http://www.aifb.uni-karlsruhe.de/Personen/index.html). The second rule ensures that whenever a document with the content "*eLearning*" is searched for, then the documents about "*TeleTeaching*" and "*WebBasedLearning*" are also found.

The context ontology is based on the pedagogical model. Concepts like "*Introduction*", "*Explanation*", "*Example*" are used to describe several types of contexts for the learning materials.

The most important part of the structure ontology are the relations between learning materials ("*preDocument*", "*nextDocument*", "*IsBasedOn*", "*IsBasisFor*") and corresponding rules. The learning materials are organized in a tree structure. The relations "*preDocument*" and "*nextDocument*" describe a sequence of the documents at the same level in the structure tree of the learning materials. The relations "*parentDocument*" and

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"*firstChildDocument*" correspond to the references between two successive structure levels. The rules in the structure ontology enable a flexible semantic navigation through the learning materials organized into a course. For example, the rule *"FORALL D1, D2 D1:Document[prevDocument->>D2] <-> D2:Document[nextDocument->>D1]."* enables to go through the learning materials in two direction (forward or backward), even though only one "path" is defined. The concepts "*Course*", "*Module*" and "*Atom*" are also part of the structure ontology. They are used to indicate the complexity of the learning materials. The simplest type of the learning materials is an "*Atom*". It is a learning material that doesn't contain any other learning material. The "*Modul*" consists of several atoms organized in a sequence and a "*Course*" is a sequence of modules or other courses. In this way a course is a tree structure of learning materials on different granularity levels. Complex structures can be derived automatically from more elementary ones by exploiting the last rule in Table 3.

Concept	Relation	Rule

Object [ ].
Document :: Object.
...
Content :: Object.
Protocol :: Content.
Service :: Content.
Topology :: Content.
Bustopology :: Topology.
Circletopology ::Topology.
...
Context::Object.
Introduction:: Context.
Explanation:: Context.
Example:: Context.
Figure::Example.
...
Structure::Object.
Course:: Structure.
Module:: Structure.
Atom:: Structure.
...
Person::Object.
Author :: Person.
Student :: Person.
PhDStudent :: Student.
...
	Document [
	name=>>String;
	title=>>String;
	path=>>String;
	hasAuthor=>>Author;
	
	content=>>Content;
	context=>> Context;
	structure=>> Structure;
	...
	prevDocument =>> Document;
	nextDocument =>> Document;
	firstchildDocument =>> Document;
	parentDocument =>> Document;
	relatedDocuments =>> Document;
	...
	IsBasedOn=>>Document;
	IsBasisFor=>>Document;
	...].
	
	Content[
	hasTopic=>>Content].
		FORALL A, B, C
		A[hasTopic->>C] <- A:Content and A[hasTopic ->>B] and
		B:Content and B[hasTopic ->> C] and C: Content.
		
		FORALL D, C1, C2
		D:Document[content->>C1] <- C1:Content and C2 :Content and
		D:Document[content->>C2] and C1[hasTopic->>C2].
		
		FORALL D1, D2
		D2:Document[prevDocument->>D1] <-
		EXISTS E1, E2, C C:Content andD2:Document[context->>E2] and
		E2:Example and D1[context->>E1] and E1:Explanation and
		D1[content->>C] and D2[content->>C].
		
		FORALL D1, D2
		D1:Document[parentDocument->>D2] <-
		D2:Document[firstchildDocument->>D1].
		
		FORALL D1, D2
		D1:Document[prevDocument->>D2] <->>
		D2:Document[nextDocument->>D1].
		
		FORALL D, S
		D:Document[structure->>S:Course] <-
		Exists D1, S1 D1:Document and (S1:Course or S1:Module) and
		D1[structure->>S1] and D1[parentDocument->>D].
		...

Table 3 Partial ontology in the eLearning scenario

All others elements of the course ontology, represented in the Tab. 3, correspond to the common metadata. For example, the attributes "*name*", "*title*", "*path*", which describe the "*Document*" concept, are equivalent to the general metadata level in the previously mentioned LOM standard.

Providing the learning materials

The first phase is the production of learning materials that may be used or reused in the construction of training courses. In order to provide learning material, which could be suitable for metadata-searching, each learning material has to be described or "enriched" with the following metadata information:

- what is the learning material about (content annotation),
- which context has the learning material (context annotation) and
- how is it connected to other learning materials (structure annotation).

This "enriching" consists of explicitly adding to each learning material a set of metadata information referring to the course ontology. Providing information is for now constrained to manually entering metadata information (facts) or to filling in ontology-based HTML forms. The metadata may be placed within the document itself (e.g. HTML <META> tags) or in some external metadata repository (e.g. an RDF repository) (Handschuh et al. 2001). In our approach it is stored externally in the knowledge warehouse.

Accessing the learning materials

In the process of information accessing, the ontology is used for:

1) Semantic querying for learning materials: A semantic query is based on the three dimensional search space (content, context, structure) that is defined by the ontology. An easy-to-use interface based on the query capabilities of the F-logic query interface of Ontobroker (Decker et al. 1999) is offered for specifying such queries.

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2) Conceptual navigation through the collection of learning materials based on ontological relations between concepts in the (a) content and (b) context ontologies and on the explicit (navigational) structure defined from the author in the structure ontology (c).

(a) postulates an assumption that the semantically relevant links for the learning material correspond to the ontological relations. Two pieces of learning material indexed with two concepts that are related in the ontology are hyperlinked to each other in the user interface. For example, in the telematics domain the learning material that describes OSI layers has hyperlinks to the corresponding protocol-, service- and interface- learning materials, because the concept "OSI layer" has relations with the concept "protocol" in the telematics ontology.

(b) Navigation is also based on the rules in the context ontology. The rules describe how to organize the learning materials about the same content in a proper structure. For example, from the pedagogical point of view the learning material that explains some content must precede the learning material that is an example of the same content. It means that each learning material with a context "*Explanation*" has (hyper)links to the learning materials about the same content that have the context "*Example*".

(c) The navigational structure consists of the ordering of learning material in the learning course (first, next, parent), but it is also created by authors who define related learning materials that do not obligatory correspond to the content ontology.

Other components

The knowledge warehouse serves as a repository for data represented in the form of RDF statements. The knowledge warehouse itself hosts the ontology, the metadata, as well as the data proper. The system uses the inference engine of the Ontobroker system (Decker et al. 1999). Particularly, the inference engine answers queries and it performs derivations of new knowledge by an intelligent combination of facts in the knowledge warehouse with the ontology. The possibility to derive additional factual knowledge that is only provided implicitly frees knowledge providers from the burden of specifying each fact explicitly. Methods for personalization and semantic ranking of the results of querying the knowledge warehouse are described in (Maedche et al. 2001).

Related work

There are only a few approaches that could be compared to our eLearning scenario. The most similar approach is the system Karina (Crampes et al. 2000), which enables dynamical building of the learning courses according to user preferences. It is based on the conceptual description of learning material using conceptual graphs and uses some (prerequisite) strategies to fulfil the users' objectives in the search/navigation process. A sibling of Karina, the Sybil system (Crampes et al. 2000) uses an ontology of pedagogy for defining the context of the learning course. However, both approaches do not describe explicit an structure of the course (structure ontology in our case). The Collaborative Courseware Generating System (Qu et al. 2001) uses modern web technologies (XML, XSLT, WebDAV) for describing course structures, but without explicit ontology support. It also does not define the context and structure of the learning materials explicitly. The Ontology-based Intelligent Authoring Tool (Chen et al. 1998) uses an intelligent training system in the eLearning scenario. It uses four ontologies (domain, teaching strategies, learner model and interfaces ontology) for the construction of the learning model and the teaching strategy model, but it fails in exploiting modern Web technologies. To summarize, none of the mentioned systems uses the advantages of the Semantic Web, which is the main point in our approach.

Conclusion

"Making content machine-understandable" is a popular paraphrase of the fundamental prerequisite for the Semantic Web. In spite of its potential philosophical ramifications this phrase must be taken very pragmatically: content (of whatever type of media) is 'machine-understandable' if it is bound (attached, pointing, etc.) to some formal description of itself. This vision requires the development of new technologies for web-friendly data description. The Resource Description Framework (RDF) metadata standard is a core technology used along with other web technologies like XML. Ontologies are (meta)data schemas providing a controlled vocabulary of concepts, where each concept comes with an explicitly defined and machine processable semantics. By defining shared and common domain theories, ontologies help both people and machines to communicate concisely, supporting the exchange of semantic content instead of syntactic structures.

In this paper we have presented an eLearning scenario that exploits ontologies in three ways: for describing the semantics (*content*) of the learning materials (this is the domain dependent ontology), for defining the learning *context* of the learning material and for *structuring* the learning materials in the learning courses. This three-dimensional, semantically structured space enables easier and more comfortable search and navigation through the learning material.

The purpose of this paper was to clarify possibilities of using the Semantic Web as a backbone for eLearning. Primarily, the objectives are to facilitate the contribution of and the efficient access to information. But, in general, a Semantic Web-based learning process could be a relevant (problem-dependent), a personalised (user-customised) and an active (context-sensitive) process. These are prerequisites for realizing efficient learning. This new view enables us to go a step further and consider or interpret the learning process as a process of managing knowledge in the right place, at the right time, in the right manner in order to satisfy business objectives.

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Web Applications for Communication, Community Outreach, and Student Recruitment and Retention in Teacher Education: An Ongoing Evaluation

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Abstract: Over the last five years, the authors have examined how teacher educators in university programs (SCDEs - schools, colleges, and/or departments of education in colleges and universities) have made use of the World Wide Web to communicate with other potential and current educators (defined as *cybercasting*). An evaluation matrix was developed to demonstrate which programs are exemplary, have models of effective Web use, and which may be followed as best practices. The authors have expanded their examination from 50 to 70 Websites of SCDEs, and have expanded the foci of their matrices to reflect changing uses. The current study reviews changes in the uses of the WWW by teacher educators since 1996, and projected directions for the future.

The authors, faculty members in teacher education programs in California and Connecticut, have been reviewing the use of the World Wide Web (WWW) by teacher education programs since 1996. They have chosen the term *cybercasting* to represent how teacher educators use the WWW to reach specific audiences of educators, as well as to make information about their programs and activities accessible to all who seek the knowledge. The number of sites reviewed and the nature of the reviews have expanded in the last five years – going from a review of the functions of Websites for teacher educators, to an evaluation of Web presences of teacher education programs, to a discussion of how these Web presences foster educational leadership, and to a showcase of programs which make use of their Websites to share responsibility for recruiting and retaining caring and competent teachers. The authors have also expanded the focus of the discussion to how teacher educators use communication on the WWW for sharing leadership and for expanding online opportunities and access for all learners.

The 1996 Teacher Education Cybercasting Review

During the second half of 1996, Stoloff (1997) examined applications of the WWW that might prove useful for the expanding roles of leadership in teacher education and higher education reform. These emerging applications were seen as tools for expanding student recruitment, admission and retention, curriculum development and implementation, multi-media linkages, learning communities, Academy discussions, school-university partnerships, community outreach, research, and assessment, and professional placement.

Some findings included that of the one hundred teacher education Websites that were initially selected in June 1996, 24 had moved to other sites by February 1997. Several sites that once offered music or public documents were closed to free access by Web wanderers. Other sites had been upgraded and moved to their own servers - particularly those of the professional societies. The use of video for transmitting information on the WWW seemed to be limited, while examples of the use of small audio segments were evident. During the latter part of 1996, there seemed to have been increased interest in placing course materials and distance learning courses on the WWW.

The 1998 Review of Cybercasting for Teacher Education

Stoloff and Mach (1999) expanded on the previous review by developing a grid for evaluating teacher education Websites. Fifty-one teacher education programs' Websites were reviewed for the following indicators:

- *Knowledge* - websites have a school address, faculty directory, program listings and descriptions.
- *Application* - items listed above plus syllabi of courses.

- *Synthesis* - items listed above plus posted student assignments, chat rooms for online discussions, faculty works in progress and papers.
- *Evaluation* - items listed above plus online formative evaluation.

The authors found that none of the teacher education Websites had a perfect score in 1998. One feature that was frequently missing from the SCDE homepage was the address and phone number, although it was often clearly present on the university's homepage, or easily accessible through a link. Most SCDE Websites did not have a formative program evaluation posted, but there were many that did have email addresses for any type of informal feedback. Clarity of navigation was essential. Those Websites that went beyond the knowledge level for all of their programs, as well as most of their faculty and courses were truly impressive. Taking advantage of all that electronic communication has to offer, they presented a clear inviting picture of the pursuit of a career in education.

The 1999 Review of Cybercasting for Teacher Education

Stoloff and Mach (2000) reviewed how teacher education programs discuss their PK-12 school-university collaborations on the World Wide Web. Over 50 teacher education Websites were reviewed for the presence of:

- *Centers* - Websites of SCDE institutes and offices that explore specialized topics in education.
- *PK-12 Teacher/Student Resources* - Websites with resources for PK-12 learning and teaching, not specified for particular schools or programs, summer institutes for PK-12 students and/or teachers, academic year efforts to share resources with schools by SCDEs.
- *PDS* - Websites of professional development school relationships between schools and the SCDEs and other agencies, thus forming a new entity that is shared by the SCDE and the PK-12 schools.
- *Regional collaboratives* - PK-12 schools in consortium with the SCDE as one of several (many) partners.
- *School homepages* - PK-12 school Websites housed on university servers as a service.

The reviewers were able to find examples of all of these kinds of Websites among the teacher education programs, with some of the more advanced Websites and programs offering all of the elements within their cybercasting.

The 2000 Reviews of Cybercasting for Teacher Education and 2001's New Directions

Mach and Stoloff (2001) found changes in cybercasting in the last two years. Teacher education Websites in general have become more navigable and more attractive. Faculty homepages are far more common, although not necessarily as informative as one might prefer. Online courses now proliferate, whereas in 1999 they did not. When syllabi were found in 1999, they were open to review by the casual observer. Now more and more frequently, the pages are created within a closed system for which a password is necessary, as in *Blackboard* or *WebCT*.

Stoloff and Mach (2001) examined online resources which expand the roles of educators, including models of virtual high schools, school-university partnerships and their online courses for future teachers, general education courses for undergraduates, online teacher education courses and resources for upper division or graduate students, inservice coursework, graduate teacher education programs online, and professional development learning communities for educators. This study documented the potential of online resources to augment, supplement, and supplant the formal structures of schooling.

As we explore Web use by SCDEs in the future, we anticipate a trend toward utilizing the exemplary features. We look forward to increased sharing of experiences in the applications of the WWW in teacher education and in higher education in general, as well as increased collaboration across institutions, including the possibility of developing an international consortium of online educators.

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Meeting customer expectations through web usability and design: A collaborative effort between The Ohio State University's department of design and Nationwide Insurance Systems (Nationwideinsurance.com)

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Introduction and Intent

Conducting transactions via the Internet represents a fundamental shift in the way corporations conduct business. Furthermore, the new medium of screen based communication presents new challenges, obstacles and opportunities for marketers, designers and web developers.

User-centric approaches to design and usability are now critical to guiding design solutions for the WWW, especially in the area of electronic commerce. The primary objective for any electronic commerce web site should be "ease of use" for customers to perform tasks. Involving the user in the design process will facilitate directed solutions based on customer needs, experience levels, and expectations, not the assumptions of designers, developers, or marketers.

In order to rebuild a "corporate culture" capable of solving these unique problems, it has become critical that we reach a point of meaningful collaboration between academia and corporate environments. A convergence of resources is necessary to develop business solutions that leverage usability principles and user-centric design expertise from university research, with the resources and application expertise of business. This "co-evolution" presents exceptional opportunities for cooperative growth, strategic planning, and unique solutions that achieve multiple objectives. Furthermore, such collaborations contribute to the growing body of knowledge in the field of web usability and design application.

The intent of this paper is to outline a case study of one such collaboration. Nationwide Insurance (Columbus, OH) teamed up with the department of design at The Ohio State University, to develop a process that has yielded several customer and corporate benefits. The collaborative web usability and design project included a comprehensive report, heuristic review, usability analysis, redesign recommendations, and implementation. The newly designed web site has been recognized as #1 in usability by Kasina in their March 2001 report (which rates web sites in the Property and Casualty industry), and has made significant advances in the Gomez ratings. The paper details the applied process, and proposes a model for further academic and corporate collaborations. The resultant benefits of the project from the perspectives of academic research, corporate application, and customer benefit will be illustrated.

The Process

In September 2000, Nationwide Insurance was given the charge to evaluate the current condition of their web site, identify weaknesses and opportunities, propose, and implement a newly designed site that satisfied several objectives. The primary goal was to deliver a site that would allow their customers to be able to find information and perform tasks with minimum difficulty and maximum efficiency. It was established that all stakeholders were to be involved in the process and implemented using in-house resources. This included business, marketing, IT, design, and most importantly customers.

To achieve this goal, Nationwide Insurance collaborated with the department of design at The Ohio State University to formalize a web usability and design team. OSU provided the needed research background, methodologies, design process and expertise. Nationwide provided the implementation resources and staff to conduct a large-scale usability study, as well as programming and IT resources to apply design recommendations. A consulting firm, Human Factors International, was also contracted to provide usability data analysis, training and input to the navigational structure.

The results of the usability study provided guided intelligence to be used in a redesign of the Nationwide Insurance web site. Several new objectives were outlined and implemented:

- Develop a site that was usable and useful to customers
- Integrate usability principles into the corporate culture
- Implement a "call to action" to facilitate the ease of transacting on the site
- Flatten navigation
- Revitalize the look and feel and enhance the Nationwide Insurance brand
- Develop an architecture that was easy to navigate

The collaboration between Nationwide Insurance and Ohio State University's department of design continues and is expected to be an ongoing activity. Followup studies and focus groups reviewing the current site have reaffirmed that the site has made vast improvements and continues to meet or exceed the expectations of our customers.

The results of the usability study revealed several areas that needed improvement if the site was to achieve customer-centric goals. Some of those items were:

- The benefits of the site were not very apparent
- The structure and organization of the site was not as clear as it should be
- The web site was structured too deeply in many places
- New visitors would have a hard time finding many of the features
- The information architecture and the content hierarchy was poorly structured
- The branding elements interfered with effective page layout
- Portions of text were not structured for effective reading on screen
- Spanish language link was not located in a conspicuous area of the homepage

The results of the usability study provided design recommendations that have yielded several customer and corporate benefits. The site has been recognized as one of the easiest to use in its industry.

e-Portfolio: Java Technology for Financial Applications on the Internet

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Abstract: The rapid introduction of Internet technologies in the financial sector is leading to profound changes affecting both financial service companies and private investors. Web-based technologies have transfigured our concept of information availability, and are transforming the way customers and service providers communicate and relate to each other. This poses new organizational and computational challenges. In this paper we describe *e-Portfolio*, a Java-based financial application that gives assistance in the choice of an optimal investment strategy according to an investor's profile. *e-Portfolio*'s highly portable, interoperable, and reusable components result in a very flexible architecture that can be accommodated to different business settings and requirements. A demo of the application can be found at [http://www.risklab-madrid.uam.es/e-portfolio].

Introduction

The market for financial products is undergoing a substantial transformation with the advent of technologies that facilitate their trading on the Internet (Gebase 94). Given the complexity of financial markets and the wide variety of products available, the issue of providing accurate, clear and detailed information and a good quality on-line service to the customer is of particular importance (Janal 98). Consider the mutual funds market, which is the focus of the present work; the investor is faced with a choice amongst over 10,000 different products in the US, and a similar amount in the European market. Each of these funds has different characteristics (expense ratios, sales charges, minimal investment, and so on) and exhibits a different performance (expected profit, risk profile, etc.). The daunting task of finding the best investment strategy in this vast universe of possibilities requires the use of sophisticated tools. There are several computational issues that have to be addressed in order to solve the problem. A first aspect is the requirement to elaborate information which is in raw form in a database, so that it can be rendered useful. The selection of the "best" portfolio involves a numerical optimization, which is a computationally intensive numerical task. Finally, the need to access large databases, whose contents may be proprietary, and to computational resources suggests that a Web-based architecture is the suitable choice. *e-Portfolio*, the application presented in this paper, takes full advantage of Java and Internet technologies, leading to highly portable, interoperable and reusable software.

Architecture and functionalities

The objective of *e-Portfolio* is to extract and elaborate the information from historical records of the evolution of mutual funds in order to assist a private investor to select an adequate portfolio, suited to the individual's characteristics (risk profile) and expectations about the outcome of his or her investment. *e-Portfolio* users are either financial advisors (through an Intranet), or private investors accessing the application directly through the World-Wide Web. The application has a three-tier client-server architecture based on Java RMI. First, a user model is generated by means of a questionnaire. The most important feature in the user model is his or her proneness to take risks in exchange of possibly higher returns (but also losses). Once the questionnaire is completed and processed, the user is prompted with a volatility range in which he or she is advised to maintain his or her portfolio.

The data management layer is responsible for accessing and updating the information about the funds stored in the database. This information is partly sent to the client as-is (e.g. for the client to visualize the evolution of a specific fund) in response to direct client queries or, more often, it is supplied on demand to the middle layer for analysis and optimization at client request. The middle layer carries the business logic. It includes three modules for incomplete time-series reconstruction, analysis and optimization. The analysis

module is a highly reusable component that transforms arrays of raw historical data from funds or portfolios into a more meaningful set of performance measures and curves that can be graphically visualized in the client. The optimization module permits the selection of an optimal portfolio (Markowitz 59). It can be used in different manners: A new investor can start from the universe of all funds available for trading and thereupon make a selection by applying a number of filters (type of fund, historical performance, expected return, risk level, company managing the fund etc.). The investor can also specify constraints for the optimization (e.g. select the desired percentage range of investment in a particular fund, or in funds of a specific type). The application then calls a numerical optimization routine, whose result is the *efficient border* (see Fig. 1, right), which is the geometric place of the points in a risk/returns diagram that are optimal, in the sense of Modern Portfolio Theory (Markowitz 59): for a given volatility (risk) they yield maximum returns; or, from an alternative viewpoint, the portfolio that for a given return level exhibits the minimum risk. An experienced investor wishing to rebalance his or her portfolio can, on the other hand, enter the actual portfolio he or she holds and compare its performance to the minimal risk or to the maximal return portfolios. The time-series of portfolio values can also be studied with the analysis module of the application. Finally, the application permits to generate reports in Word of HTML format of the analysis carried out.

The user interface layer consists of a) a set of tools to edit or infer investment constraints, predefined portfolios, and investor profiles, b) an interface for incomplete fund reconstruction, c) a component for defining optimization requests and visualizing the results returned from the server (e.g. the efficient border curve, see Fig. 1, right), and d) an interface for visualizing the analysis of funds and portfolios (Fig. 1, left).

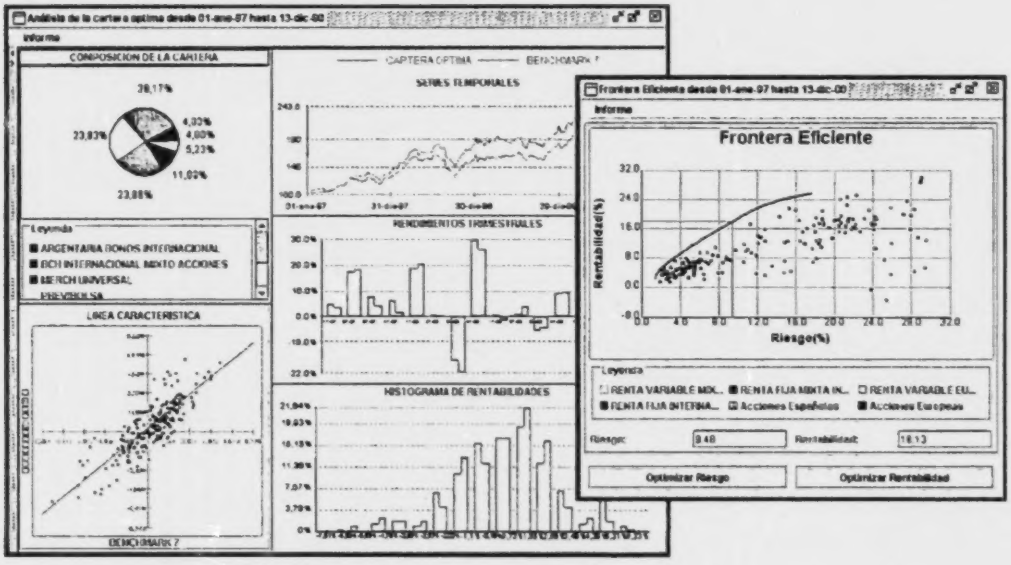

Figure 1: Efficient border (right) and analysis of optimal portfolio (left) in the e-Portfolio environment

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CollaBoard:
Web-based Collaborative Learning System Using SVG

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1. Introduction

We have developed a system called "CollaBoard", which supports "Project-based Learning (PBL)". It can work with other systems as well and has been effectively used with them. Although it seems like a shared-whiteboard, it has many other features: personalized canvas, dynamic grouping using multi-layers, sharing and delivering of documents, and archiving of user's interactions. It can be used like a notebook, whiteboard, or paper depending on the learning situations. Since it employs "Scalable Vector Graphics (SVG)"[1], its data can conveniently be converted for or reused on other platforms. CollaBoard enables you to collaboratively make notes, search out and correct information, review your actions, and exchange data with distant schools as well. In Japan, "Integrated Study" will be introduced in elementary and secondary education. It is usually based on PBL and collaboration. Recently, there have been many tools for e-learning on the web. However, they are not sophisticated enough to be used in PBL situations. For example, although text-based tools such as bulletin boards or chat rooms are usually used for discussions, they are difficult to use for other purposes, like correcting data or giving presentations to other students. Although some of them use shared-whiteboards, many of them are simply "drawing tools". They are not satisfactory for collaborative learning use because they lack of necessary features, such as dynamic grouping or document sharing. CollaBoard can provide solutions to these problems. This paper explains the concepts and implementation of CollaBoard and shows, using examples, its applications.

2. Concepts and Major Features

In developing CollaBoard, we analyzed the learning process of integrated study, and identified tools used in each situation. Figure 1 and Table 1 show the (general) learning process of integrated study.

Stage	Find	Research	Summarize	Present
Tools	blackboard, notebook	shared-paper, post-it whiteboard, notebook	shared-paper, whiteboard, notebook	blackboard, shared-paper notebook

Table 1: (General) Leaning process of integrated study

Based on analysis, the system requirements are as follows.

(1) Platform-free implementation
(2) Note, draw, research, summarize, and archive results
(3) Distribute and share the information among group members as well as between other groups
(4) Dynamic re-grouping (change student's role or interest as the class progresses)

We propose the following features to provide solutions to above requirements.

i) SVG based data format

There are many data formats for graphics. For example, Nakagawa suggested using HandsDraw [2]. However we chose to use SVG as the data format of CollaBoard because it is an XML-based format that we think will become the next standard graphics format on the web. It is easy convert or reuse and can be viewed on any platform. Additionally SVG enables you to link objects with URLs or files. It provides solutions to (1), (2) and (3). We proposed linking objects with URLs or files and sharing them, using the drag-and-drop method. Employing SVG enabled us to develop the features such as exchanging the data or archiving and reviewing user actions.

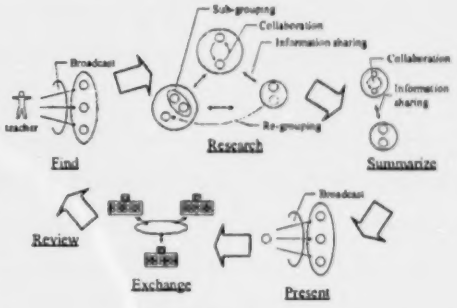

Figure 1:

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ii) Multi-layer canvas architecture

This feature enables CollaBoard to dispatch information to specific users or create groups dynamically. With combinations of layers, CollaBoard provides us with virtual tools such as a whiteboard or notebook. For example, this feature is useful for group-learning, in which the teacher forms students into groups. Each group needs a whiteboard for its discussions. The teacher needs a whiteboard to give information to all the students. When the teacher wants to advise one group directly, he/she needs to join them and write on their whiteboard. Finally each group presents their results to the other groups after discussions have finished. CollaBoard supports such a class. It allows specific layers to be assigned flexibly. Figure 2 shows the multi-layer canvas. This architecture provides solutions to (3) and (4).

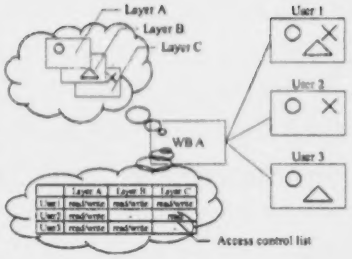

Figure 2: Multi-layer canvas

3. System Configuration

CollaBoard consists of a server module and client modules. Clients connect to server and collaborate with each other. A client can also run independently without the server. The server has many collaborative spaces called "Whiteboards (WBs)" and each WB has a list of users. A WB has many layers and each layer has a user access control. The server can manage user sessions, deliver messages to specific users, and archive the interactions. Connections can be TCP or HTTP, depending on the proxy used on the network. Figure 3 shows an overview of the CollaBoard system. We implemented the server by Java, Servlet/JSP, and database, and the client using ActiveX Control, because we think that the server should run on several OS such as Windows, Linux, or Solaris, and that clients will work better with various applications.

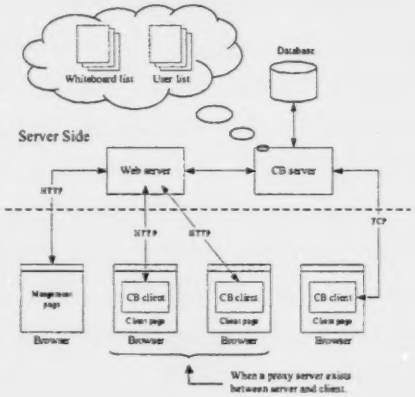

Figure 3: Overview of CollaBoard

4. Applications

CollaBoard is currently being used for applications. One is a "Distance Correction System for Cartoons", in which professional cartoonists correct cartoons that students submit via the web. They said that it is effective in allowing them to directly correct cartoons and advise students remotely. The other is "Real Time Mentoring System", in which a mentor, using MESIA [3] with CollaBoard, gives visual advice to students who are in a state of deadlock. Both systems support collaborative work. They are in practical use now. Both are good applications to show CollaBoard's effectiveness. Further more, as an application of CollaBoard, we will develop a collaborative system for creating neighborhood map. It works as follows: First, each group member researches about the neighborhood. Then, they all go out and photograph the street scene or buildings. Next, they draw a map and paste in the photos on CollaBoard. A lot of information is filled in objects on the map. Finally each group presents their results to the others, puts them on the net, and exchanges them with other schools. It will be a fairly typical system using CollaBoard.

5. Conclusions and Future Work

So far we have proved that CollaBoard is sufficient for collaborative learning. As future work, we will develop several systems for integrated study using CollaBoard, and perform experiments and evaluate them.

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The Interaction of Learner Characteristics and Instructional Design: The Need for Applying Educational Psychology Theory to Instructional Technology Research

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A shift is occurring in teaching and learning due to the increased use of technology, both in and out of the classroom. Unfortunately, the advancements in technology are outpacing the advancements in our understanding of the psychological aspects of working with computers. There is a tremendous need for applying educational psychology theories to instructional technology research to determine which types of instructional design methods and supports could improve the learning process and make it more effective and efficient for students in this new medium.

One well-developed area of educational psychology is strategic learning research. Educational psychologists describe strategic learners, or self-regulated learners, as learners who are behaviorally, motivationally, and metacognitively active participants in their own learning (Zimmerman, 1986). Learners can influence how they process incoming information, and in turn to what degree they actually "learn" the information and transform it into organized knowledge (Weinstein, 1994). Self-regulated learning has been termed the highest form of cognitive engagement (Corno & Mandinach, 1983), yet many students have difficulty adjusting to a self-regulated environment because they lack the effective strategies necessary to succeed (McCombs, 1988). Hypermedia educational programs can provide powerful environments for student-directed strategic learning, but some learners may not be prepared to take on this active role.

It is also becoming apparent that the research on learning with hypermedia needs to be based on a theoretical framework (Astleitner, 1997). Recent instructional technology research suggests that the learner's characteristics are interacting with the design characteristics to result in various levels of performance (see Tergan, 1997). Applying the conceptual frameworks and findings from strategic learning research in traditional learning environments to the research in hypermedia learning environments should be helpful in preparing students to work effectively and efficiently in hypermedia learning environments.

Research Study

The purpose of this research study was to investigate the relationship between college students' hypermedia navigation and strategic learning. The study was designed to answer four research questions: 1) Can we identify meaningful clusters of students based on their navigational patterns in a hypermedia learning environment? 2) Are there differences between navigational profile clusters with respect to students' mean achievement scores? 3) Is there a range of scores with respect to achievement within any of the navigational profile clusters? 4) Is there an interaction effect between cluster membership and strategic learning in predicting achievement?

The conceptual framework for the research was Weinstein's Model of Strategic Learning which focuses on the interactions among its three components: Skill, Will, and Self-regulation (Weinstein, 1994). The Skill component consists of the types of knowledge that strategic learners possess, ex. knowledge of themselves as learners, knowledge about cognitive strategies, and prior content knowledge. The Will component consists of the affective aspects of the learners, such as their motivation, academic goals, beliefs, and volition. The Self-regulation component consists of the learners' metacognitive awareness and control.

Participants

The participants in this dissertation study were 260 undergraduates enrolled in the first year, first semester French courses (FR 506) at a large southwestern state university.

Instruments

Dependent Variable

Achievement

Achievement was measured by averaging the students' chapter exam grades for the two chapters that correspond to the log files that were analyzed in this research. The chapter exams were created by the supervisor of the FR 506 class and consisted of a variety of listening comprehension exercises, reading exercises, and written exercises.

Independent Variables

Each of the following instruments assessed a different aspect of the Model of Strategic Learning. The variables examined in the Skill component included Prior Content Knowledge, Knowledge of Learning Strategies, and Computer Literacy. The variables examined in the Will component included Goal Orientation, Instrumentality of the Course, and Computer Anxiety. The variable examined in the Self-regulation component was Metacognitive Self-Regulation.

Prior Content Knowledge

Each student's prior knowledge of French was assessed by the student's score on the first chapter exam. This exam was given during the second week of the semester.

Computer Literacy

The Computer Interface Literacy Measure (CILM) developed by Turner, Sweany, and Husman is a self-report instrument designed to measure students' computer literacy for using the graphical interfaces associated with operating systems, hypermedia applications, and the Internet (α=0.90).

Learning Strategies

The students' knowledge of learning strategies was assessed by the students' scores on the Selecting Main Ideas and Test Strategies subscales of the Learning and Study Strategies Inventory (LASSI) (α = .88).

Goal Orientation

Midgley et al. (1997) have developed the Patterns of Adaptive Learning Survey (PALS) which contains a scale designed to measure personal goal orientations. The Task Orientation scale was used to assess students' levels of task goal orientation for this study (α = .83).

Computer Anxiety

Reed and Palumbo (1987) have modified Spielberger's Self-Evaluation Questionnaire (1972) so that each of the items relates directly to feelings towards the computer. This 20-item instrument uses a 4-point Likert scale (α = .92).

Instrumentality

Husman (1998) has adapted a short, four-item instrumentality scale from Van Calster, Lens, and Nuttin (1987). The scale assesses students' perceptions of the instrumentality, or the usefulness, of a specific course to their future (α = .83).

Self-Regulation

Self-regulation was assessed by the Metacognitive Self-regulation subscale of the Motivated Strategies for Learning Questionnaire (MSLQ) (α = .79).

Procedure

The students went as a class once a week to the computer lab to work with the *Paralleles Interactive* CD-ROM. No specific assignment was given to the students. They were simply asked to work through the chapter at their own pace, in whatever order they chose, and they could access all, some, or none of the available features. As the students worked with the CD-ROM, their navigational paths were automatically logged by the computer.

The computer kept track of the students' time on task as well as their frequency of accessing nodes containing vocabulary information; listening to full-length audio; listening to line-by-line audio; accessing the dictionary; answering the comprehension questions; and accessing the Internet.

Methodology

Cluster analysis was performed on the students' log files to examine patterns of individual differences based upon the computer features accessed by the students. The log files were coded according to: time on task; frequency of accessing nodes containing either grammar, lexical, or cultural information; listening to full-length audio; listening to line-by-line audio; accessing the dictionary; answering the comprehension questions; and accessing the Internet. This coding yielded six navigational variables for each student, which were entered as the dependent vector of scores for each participant in a Ward's hierarchical cluster analysis (Aldenderfer & Blashfield, 1984).

RQ 1: Can we identify meaningful clusters of students based on their navigational patterns in a hypermedia learning environment?

The cluster analysis result is presented in Table 1.

TABLE 1: MEAN FREQUENCY SCORES FOR THE CLUSTER SOLUTION

	Cluster 1 (n=25)	Cluster 2 (n=122)	Cluster 3 (n=113)
Audio	7.48	16.89	11.86
Line Audio	127.48	5.22	3.69
Vocabulary	82.64	115.30	42.50
Comp. Ques.	19.36	31.21	14.43
Dictionary	.56	.85	.37
Internet	.04	.48	.21
Time (in sec.)	3284.48	2736.14	2180.96

Significant differences across the clusters were found for all variables except for accessing the Internet. The Dictionary and Internet features were accessed infrequently by students in all of the clusters. The cluster solution suggests that the students in Cluster 1 used the Line Audio features the most, whereas the students in Cluster 2 accessed the Vocabulary links and Comprehension Monitoring Questions the most. The students in Cluster 3 spent the least amount of time on task and tended to access the least amount of features overall.

RQ 2: Are there differences between navigational profile clusters with respect to students' mean achievement scores?

The second research question concerned whether the students in one navigational profile cluster performed better on the average of the two chapter exams than students in the other navigational profile clusters. The mean achievement score for each cluster is shown in Table 2.

TABLE 2: AVERAGE EXAM SCORE FOR EACH CLUSTER

Cluster	N	Mean	Std. Deviation
Cluster 1	25	83.02	8.57
Cluster 2	122	79.23	12.83
Cluster 3	110	76.03	12.50

In order to test the differences present in the sample, a one-way ANOVA was performed on the dependent variable achievement score and the independent variable cluster membership. The analysis indicates a significant difference in students' average achievement scores based on cluster membership, $F(2,254) = 4.027$, $p < .02$.

Secondary analyses were performed to investigate whether the clusters differed on any of the strategic learning variables. The decision was made to combine the standardized goal orientation, course instrumentality, and metacognitive self-regulation scores into one predictor because of the small number of items on each scale (5, 4, and 12 items respectively). This resulted in a 21-item predictor that was named Strategic Learning ($\alpha = .81$). Thus, the variables examined included Prior Knowledge, Strategic Learning, Learning Strategies, Computer Literacy, and Computer Anxiety. Five one-way ANOVA's were run with cluster membership as the independent variable and Prior Knowledge, Strategic Learning, Learning Strategies, Computer Anxiety, and Computer Literacy as the dependent variables. A main effect was found for Strategic Learning, $F(2,256) = 3.843$, and Computer Literacy, $F(2,256) = 3.240$, $ps < .05$.

Since five analyses were conducted, a Bonferroni adjustment of $\alpha = .05$ divided by the number of comparisons (5) was performed to maintain the experimental Type I error rate at $\alpha = .05$. Therefore, a variable needed to have a significance level of $p < .01$ to be considered statistically significant. None of the variables met this stricter criteria, although the variables of Strategic Learning and Computer Literacy approached statistical significance. For discussion purposes, the means of the standardized Strategic Learning and Computer Literacy variables for each clust er are shown in Table 3.

TABLE 3: STRATEGIC LEARNING SCORE FOR EACH CLUSTER

		Strategic Learning		Computer Literacy	
Cluster	N	Mean	Std. Deviation	Mean	Std. Deviation
Cluster 1	25	1.055	2.332	.020	.972
Cluster 2	122	.037	2.102	.157	.909
Cluster 3	112	-.266	2.186	-.173	1.076

While the clusters did not significantly differ on any of the variables, there is a pattern of the students in Cluster 3 consistently reporting lower scores than the students in Cluster 1 or Cluster 2 for this sample.

RQ 3: Is there a range of scores with respect to achievement within any of the navigational profile clusters?

Table 4 presents the percentage of students who fall into the top, middle, and bottom one third of the overall exam score distribution for each cluster.

TABLE 4: EXAM SCORE DISTRIBUTIONS

	Cluster 1		Cluster 2		Cluster 3	
Exam Score	N	Percentage	N	Percentage	N	Percentage
Top 1/3	13	52.0%	44	36.1%	29	25.7%
Middle 1/3	9	36.0%	40	32.8%	37	32.7%
Bottom 1/3	3	12.0%	38	31.1%	44	38.9%
Total	25	100.0%	122	100.0%	110	100.0%

RQ 4: Is there an interaction effect between cluster membership and strategic learning in predicting achievement?

A one-way analysis of covariance was run across cluster membership with exam score as the dependent variable and the five strategic learning variables as the covariates. The results of the ANCOVA indicate that no significant interaction effect exists for cluster membership and any of the strategic learning variables. In other words, using particular computer features did not seem to benefit more strategic learners. This result may be due to the fact that the features available in this particular computer program did not necessarily support strategic learning, therefore particular features were not

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helpful to more strategic learners. In other words, there was not a correspondence between the computer features available and support of learning strategies.

Discussion

The results suggest that there are differences in students' hypermedia navigation and that students' achievement differs with respect to their hypermedia navigation. While further research is necessary, the findings also indicate that strategic learning may mediate the relationship between hypermedia navigation and achievement. The research suggests that not all students will automatically use hypermedia programs effectively. Future research investigating the nature of strategic learning in hypermedia environments, as well as training and attention to instructional development with respect to the design of computer tools and additional features should help students to work more effectively in hypermedia learning environments.

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Learning in Desktop Video-Conferencing Environments

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Abstract: *Luleå University of Technology has since 1997 used net-based learning environments based on desktop video-conferencing tools to distribute courses to students. It has been claimed that the environment gives remotely attending students equal possibilities as traditionally attending students to take an active part of a course, as well as enhancing the learning experience for all students. This is in part true, but in reality there are many pedagogical and technical obstacles to overcome before a course can be seen as successful. This paper identifies a number of problems, which will be considered from both a pedagogical and technical perspective.*

1. Introduction

The use of information technology is today an integrated part of higher education in Sweden, where electronic distribution of information to students is maturing as usage is increasing. However, a common deficiency found in the use of net-based learning environments is the lack of support for spontaneous interaction between students as well as between students and teachers. Functionality like real-time textual chat and video-conferencing enhance the possibilities for communication, creating environments that not only distribute static information but also allow a higher level of interaction. The potential of modern environments for net-based learning is large, but the question is if we take advantage of that potential by the way we use them today.

There is a common belief that use of information technology will enhance and stimulate learning. That belief has little foundation, as we cannot say for sure that the impact from information technology on learning is positive. Some authors suggest that it is hard to see if the information society has improved learning at all. The truth would rather be that technology alone, no matter how futuristic or exciting, does not automatically improve the learning process (Dertouzos 1997, p. 177).

There are three classical motives for the use of information technology in learning (Broberg 2000) are economical (learning more at a lower cost), learning efficiency (learning more during less time) and bridging distances in time and space (learn at anytime, from anywhere). These motives hardly apply to communicative learning theories and methods such as collaborative learning, problem-based learning, in-depth learning, etc (Koschmann 1996).

Today we have an ideology where communicative learning theories are connected to information technology but the fact is that the ways we use information technology do not lead to communicative learning. Different studies identify several problems with using net-based learning environments (Dertouzos 1997, Healy 1998, Phipps & Merisotis 1999 and Synnes 1999). There are today few, if any, sufficiently complete net-based learning environments based on pedagogical theories and methods that are built in a user friendly way. There are still several basic issues to correct for current net-based learning environments.

In this article we will highlight the use of desktop video-conferencing in educational settings. We will discuss some of the problems we have identified when using synchronous systems in education and what kind of relation it has to learning. The reflections in the article are based on studies of one distance course at the Mid Sweden University and one campus course at Luleå University of Technology. There where eight participants in the distance course and 20 participants in the campus course. Because of the limited sample size we cannot draw any statistically ascertained conclusions. Instead the results should be seen as indications and not as general conclusions. Students answered questions via questionnaires about their experience of using desktop video-conferencing. The distance students answered a questionnaire at three different occasions: in the beginning, in the middle and at the end of the course. The campus students answered a questionnaire at the end of the course. An interview was also done with the teacher in the distance course. The motives for using desktop video-

conferencing environments differed between the courses. In the campus course the main motive was to distribute lectures. In the distance course focus was not directed only on distributed lectures. Collaboration and communication between students was a major goal. In order to achieve the goal the course was designed around group work and tasks that should be discussed in the desktop video-conferencing environment. Both group of students had good experiences of computers and of using asynchronous tools in educational settings.

2. Background

The net-based learning environment used at Luleå University of Technology is Marratech Pro. It consists of a number of integrated tools for synchronous communication with audio, video, whiteboard, text-based chat and web pages (synchronized browsing used for slides during presentations). The environment is highly flexible and is used for anything from small electronic meetings to large distributions of presentations. Everything can be recorded and later replayed either to a single user or to a group of users. This adds to the flexibility as teachers can prepare recorded material for the students to discuss in groups. Figure 1 depicts a recording of a class in Spanish for secondary school students.

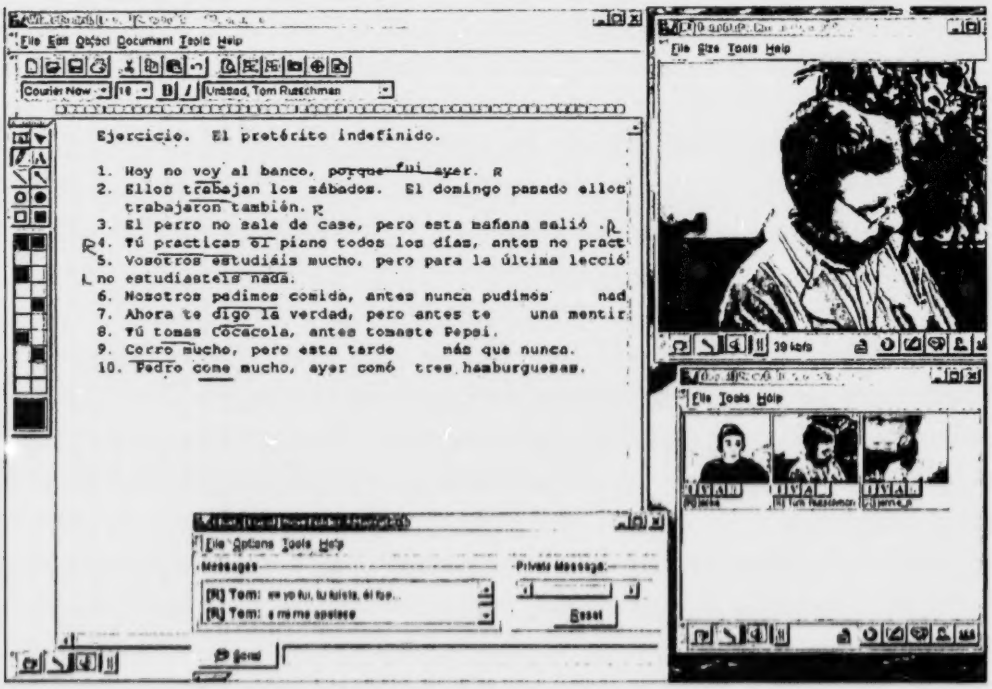
Ejercicio. El pretérito indefinido.
1. Hoy no voy al banco, porque fui ayer.
2. Ellos trabajan los sábados. El domingo pasado ellos trabajaron también.
3. El perro no sale de casa, pero esta mañana salió.
4. Tú practicas el piano todos los días, antes no practicaste.
5. Vosotros estudiáis mucho, pero para la última lección no estudiasteis nada.
6. Nosotros pedimos comida, antes nunca pudimos nad
7. Ahora te digo la verdad, pero antes te una mentir
8. Tú tomas Cocacola, antes tomaste Pepsi.
9. Corro mucho, pero esta tarde más que nunca.
10. Pedro come mucho, ayer comió tres hamburguesas.

Figure 1, a recording of a class in Spanish for secondary school students.

As described in Synnes 1999, the environment can be used for large-scale distributed lectures (the traditional method of giving lectures, but also project presentations and seminars), virtual communities (continuous sessions, which all participants of a course joins when active), virtual teachers rooms (virtual corridors where most teachers can be reached during office hours) and virtual group rooms (a session per group, which students join when working in groups).

The environment uses a network technique called IP Multicast (Deering 1991) to distribute data efficiently between all participants. If IP Multicast is not available, then clients can either connect directly to each other (with the limitation of only two clients in the same session) or via a proxy server (with no limitation on the number of clients but with an increased use of bandwidth).

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3. Some reflections from the study

The current environments for net-based learning use both asynchronous and synchronous interaction between students as well as between students and teachers. These environments are widespread, especially the numerous asynchronous environments. The usage of them is however not optimal.

One major issue is many students' inability to communicate and discuss within these environments. Research shows that activity and communication in net-based learning environments is low. This means that a positive climate for learning is reduced, as interaction is one of the enabling factors for learning. Haythornthwaite et al 2000 showed that only a minority of students developed patterns for communicative learning in electronic discussion forums. The majority of the students was not engaged and therefore did not develop patterns for communicative learning. It seems that activity is an essential part in the learning process in net-based discussion forums.

Other studies had found that the activity and communication between participants in net-based learning environments seem to have a strong connection to pedagogy. Research on text-based learning environments in higher education found that higher level of pedagogical steering and control lead to higher and deeper dialogue between participants (Hammond 2000, MacCabe 1998).

Most research from pedagogical perspectives is based on asynchronous discussions or real-time text-based chat. However, our experiences from desktop video-conferencing follow the same patterns. We can identify a risk that desktop video-conferencing lead to distribution of lectures instead of communication and reflection. Teachers use desktop video-conferencing to deliver lectures that tend to become more static than classical (i.e. non electronic) lectures, since the combination of the teachers' often pre-made material and the medium lead to little improvisation and dynamics. The poor pedagogical standpoints and the teachers inability to use desktop video-conferencing in a way that stimulate communication clearly lead to minimal or absence of discussion.

An experience from the campus course was that the students did not like lectures delivered via desktop video-conferencing tools. One student said: "The microphone puts on too late too often which tend to give an impression that the lecturer stutter and seem to be uncertain". Technology is a critical point, especially when using desktop video-conferencing tools, as non-robust technology quickly becomes a major source for limited activity and negative quality of the discussions. In the campus course a majority of the students pointed out that the technology did not worked. They said that the video and sound were not good enough when they tried to follow the lectures.

The non-robust technology also had impact on the ability for students to communicate with each other. One example was the limited communication within the groups in the distance course. Group work was one important aspect of the course pedagogy, but electronic communication within the groups did not work during the course because the technology never worked properly. One of the students said: "It became hard to cooperate when the technology was not functioning for some of the participants". The students' group-work was not satisfactory as they thought it should take place before the start of the course. For example, seven out of eight did not know what the others in the group were working with while the course was running. The result shows that network and desktop hardware issues lead to problems for the students to use the synchronous tools. This made real-time communication hard to achieve and the students had to fall back on an asynchronous environment they had used before to solve the group-work.

The result from the campus course confirms earlier experiences from courses at Luleå University of Technology where courses have been conducted as distributed courses; There need to be a clear incentive for using the technology or the students feel forced to use the environments. The result is a further lack of involvement, as they can always meet the teachers or fellow students physically. Research from communication environments at workplaces shows similar patterns, where staff does not use the technology if they cannot see what it improves or solves (Henfridsson 1999).

4. Technical issues

4.1 Network issues

One of the issues regarding video-conferencing tools is network quality. Without sufficient network resources (bandwidth) or reliability (a non-lossy network) it is practically impossible to make such an environment work. Before planning a distributed course, it is therefore necessary to make sure that the sufficient network resources are available, or a course could end quickly as a failure.

A network with low reliability (with an high amount of loss of traffic) will quickly render the environment more or less useless. A loss rate of 1-2% will make the audio tiresome to listen to. This could be partly solved by repair schemes such as repetition or interpolation, but it still affects the audio quality notably. There are other

schemes for avoiding loss, such as sending redundant data or splitting the data in important and less important parts, but most of these methods add to the network load and will make the situation even worse. Therefore it is important to maintain the network uncongested, which could be done by limiting the allowed amount of sent data per session.

The possibility to use IP Multicast is good (as it dramatically reduces the network resources used) but the technology itself is complex to setup and maintain. The result is often that the network is either saturated by faulty traffic, the data is only transferred one-way (all traffic in one direction is completely dropped), no data at all is transferred (all traffic is completely dropped) or that data is dropped at certain intervals.

The network issues are too advanced for most teachers to manage, especially when using IP Multicast, so there is a need for a network support group to maintain the network. This is however not a simple task to achieve because network maintenance is often multi-organizational and involves policies for firewalls as well as other security considerations.

4.2 Desktop hardware issues

Another issue regarding video-conferencing tools is the fact that audio hardware is practically hard to setup without risking feedback or noise. This is the top reason why people find using these environments complex – it simply requires experience to successfully setup the audio levels to avoid problems. Wizards or setup tools are available in some environments, which are good. These are however seldom used by especially inexperienced users, which are the ones that need them the most.

When it comes to installation, we face another problem. The environment is rarely written for a precise hardware, so in addition to the environment the user have to manage the operating system and its drivers (Note, video drivers under Windows are especially hard as they might need secondary support from the system, such as DirectX drivers). This might be an obstacle too big for many to overcome, and they need support to get everything working on their desktop.

A solution to avoid exposing the users to hardware issues is to install machines in study centers or to let a support center take care of installation and maintenance. Another solution is to require that the students first take a course on the environment itself, including how to install and maintain their own system.

4.3 Environment issues

A common reaction to the video quality used in low-bandwidth configurations of vide-conferencing tools (typically maximum 100 kbps of video) is that it looks bad. People are comparing the video quality to what is achieved on a TV broadcast, and off course that is perceived as much better. The result is often a loss of interest, a conclusion that is supported by the fact that few students watch a complete recording of a lecture (Synnes 1999). The audio quality suffers from the same comparison, but not to the same degree. There are two ways of handle this issue. One way is to increase the perceived quality by sending more data or using a more effective codec. The other way is to involve the student, simply activating him instead of using the traditional passive lecture model.

Another common reaction is that the student does not know when other students are on-line, as they rarely join the virtual community (the virtual corridor or shared continuous session). They often want to know who is present in the virtual community before joining. This issue is simple to remedy; present the users with information of who is within a session before joining it or to have a 'buddy list' that states what sessions the buddies have joined. Similar functionality exists in many other environments.

At last a general technical issue of a very human art namely ease of use. If the environments are not simple to use, then fewer of the students will take part of the course content. In earlier work we found that some students gathered in groups to watch recordings of lectures they missed (Synnes 1998, 1999). At first it looked like they gathered together to be able to discuss the lectures, but after some time it has come forward that they perceived the environment as complex and therefore joined a student who knew how to manage it. The flexibility of the environment used was in fact playing against itself in this case. A less flexible but simpler to use version of the environment should be considered for future use in educational contexts.

5. Discussion

The results of this study indicate that we do not currently use desktop video-conferencing in ways that will stimulate communicative learning. There are obvious needs for a net-based pedagogy, which involves course design as well as the act of teaching in desktop video-conferencing environments since the learning situation differ from the traditional classroom situation. The results from the distance course indicate that not only non-robust technology reduces communication, as it also indicates problems to achieve independence of space and

time when using synchronous tools. The distance students had irregular working habits, hence few student were on-line at the same times. As a result the students had few to communicate with when they were able to connect which decreased the motivation to connect. In the future the course design with synchronous tools have to focus much more on how to plan and design courses and part of courses that are adaptable to distance students. The teacher in the distance course says that he would have planned the teaching more rigidly with special times for communication in order to stimulate virtual meetings.

The network problems during the distance course and the distance students' problems to synchronize their work increased the need for asynchronous tools, which can stimulate group work even if the students do not meet each other via synchronous tools or physically on a regular basis. One interesting reflection from the teacher was that he claimed that synchronous communication could make the tradition of seminars possible in order to stimulate reflective learning in distance education and thus complement the use of asynchronous tools.

These reflections indicate that it is possible to combine synchronous and asynchronous tools in order to stimulate communicative learning. There is therefore a need to study if synchronous communication can stimulate the tradition of seminars and how asynchronous and synchronous tools should be integrated in order to find a balance between them for different learning situations and for different groups of students. Otherwise we will end up with environments that no one uses.

6. Summary and Conclusion

This study indicates that insufficiently functioning technology (due to network problems and incorrectly setup hardware) in combination with poor pedagogy lead to ineffective learning situtions. Research on distance education has found that pedagogy is more important than technology in order to affect learning (Phipps & Merisotis, 1999). We agree but will also claim that technology must work properly if the students should have the chance to learn at all. The use of unstable technology clearly affects the learning situation negatively for the students, which focused too much on the failing technology instead of their learning tasks. An example is that the students during the campus course refrained from using the synchronous tools due to problems with perceived audio and video quality. The teacher in the distance course said that the motivation among the students was reduced because of the problems with the network and hardware. Some important aspects of a good learning environment were put aside because of the problem with the underlying technology. It is therefore important to consider basic issues such as reliable technology and infrastructure, guidelines and pedagogical methods in order to develop easy to use learning environments that include desktop video-conferencing.

We can see that many issues raised for asynchronous environments also are valid for synchronous environments, such as low on-line activity and lack of motivation.

An important conclusion is that there is need for continuous support during a distributed course that uses more advanced technologies like video-conferencing tools. This is important not only for the setup and maintenance of desktop computers and the net-based learning environments, but also for support with pedagogical issues such as recommendation of course design and pedagogical methods and training. It is at least as important to educate the teachers about the technology and pedagogical aspects as having a working net-based learning environment. Using the most suitable pedagogical techniques is simply as important as the material to be studied, and perhaps even more so than for traditional courses.

Despite many shortcomings in current examples of distributed courses, this study shows some interesting results indicating that a combination of synchronous and asynchronous methods can be fruitful in net-based learning environments. In conclusion, attaining an effective environment for net-based learning includes not only working technology but also a well-planned course where the incentive to use the technology is clear.

7. Future work

The result of this study and the conclusions we have made has to be seen in the light of the small group of students that has been studied. We are aware of the shortcomings in validity and reliability in our results and further research in larger scale has to be done to get more valid and reliable data. It is clear that research has to consider both the pedagogical point of view as well as the technological, which other researchers also have suggested (Romiszowski & Mason 1996). We have in this paper identified some of the shortcomings and also, in general terms, discussed important aspects that may help us to overcome problems and help us to develop and modify net-based learning environments in the future.

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Inside and Outside of Webwork: Utilizing Web Projects as Resources for Collaborative Language Study and Learning

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Abstract: In this paper, we will present results from a research project with a twofold aim: Firstly, it examines learning and interaction in web-supported learning projects; Secondly, it focusses on developing a learner-centred pedagogic approach for web-supported language study. This approach makes use of the web interaction and study processes by introducing a metawork mode to help students to detach themselves from their own action and take a new look at communication and language learning. This switching between ongoing communication and perspective-taking produces pedagogic encounters during which it is possible for participants to examine and analyze different communicative actions, and explore heir beliefs and theories concerning language learning and language work. In our presentation we shall discuss the way in which we collected different types of data and our approaches to analyzing it. We shall also present the pedagogical model we have used in our project.

Introduction

New e-learning tools and environments for communication, work and learning are available for an increasing number of users. From the educational sector perspective, such a development requires a critical look at curricula and pedagogic practices. The nature of and relationship between web-work and contact teaching (e.g. their focus and relevance) needs to be considered carefully. In language teaching for instance, the vast supply of (often) written communication in web projects could be utilized to a much larger extent as authentic language learning material and as a process tool for the learners.

In this paper, we will discuss results based on analysis of data collected during 1998 – 2000 in international teacher education settings on the web and at local sites. These data originate from a long-term research project, SHAPE (Sharing and Constructing Perspectives in Virtual Environments), currently funded by the Academy of Finland and led by Sanna Järvelä, University of Oulu, Finland and Päivi Häkkinen, University of Jyväskylä, Finland (see http://wwwedu.oulu.fi/ninter/). The project has a twofold aim. Firstly, it investigates the quality and nature of interaction in higher education and workplace contexts. A parallel aim is to develop data-collection and data-analysis methods for researching web-based learning. The research group shares different kinds of perspectives into research approaches: both theory-based (Järvelä & Häkkinen 2000a & 2000b) and data-driven (Kuure, Saarenkunnas & Taalas 2001).

A special emphasis in this particular study is put on describing the learner-centred pedagogic approach for web-supported language study, which is being developed in the course of the SHAPE project. The approach makes use of the web interaction and study processes by introducing a metawork mode to help students to detach themselves from their own action and take a new look at communication and language learning. This switching between ongoing communication and perspective-taking produces pedagogic encounters during which it is possible for participants to examine and analyze different communicative actions, and explore their beliefs and theories concerning language learning and language work.

The context of data collection and the research perspective

The data used in this study were collected in the SHAPE-project at the Universities of Oulu and Jyväskylä in Finland, in different teaching contexts between 1998 and 2000. In the beginning, these two universities collaborated with the university of Indiana (U.S.) in several teacher education courses. Later on, other international partners such as the university of Warwick (U.K.) joined the group for a shorter period of time. The web-work was flexibly attached to the local curricula. The common denominator was the context of teacher education and the topics of the courses varied from foreign language education to cognitive psychology.

An important feature of the courses, which provided the data for the research group, was that they were part of the regular curriculum of the participating institutions. This has the advantage of studying the phenomena in natural settings during longer periods of time instead of solitary test situations. This is essential from the point of view of the qualitative research approach adopted for the study which emphasizes the cultural perspectives of interaction (cf. Hine 2000, Silverman 1993).

For research purposes, a variety of data-collection methods were applied. Because the context of web-based learning extends beyond mere web-work, the individual postings and collaboratively produced discussion threads constitute only a fragment of the students' study processes. If we are interested in the learning process and for example the students learning experiences we need multiple sources and types of data. In our case, participant observations and recordings of class sessions, together with recorded peer interviews, provided valuable information on the student experience of the web-work.

The data-driven discourse approach, draws from such research paradigms as conversation analysis and discourse analysis of the constructionist type that emphasize the nature of discourse as situated, constitutive use of language in sociai settings. (cf. Atkinson & Heritage 1984, Goffman 1981, Potter & Wetherell 1992) Text in a virtual environment does not reflect the conscious meanings and intentions of the writer, although it is an attempt by one person to make connections to others (Denzin 1999). Every time a text is read, in a new context by a new reader, it is given new meaning(s). A posting in a virtual learning environment is given meaning(s) when it is acted upon – inside or outside the virtual interaction. The types of data gathered in the SHAPE project are illustrated in Table 1.

Many aspects of the students' working process can be captured through the electronic data, automatically stored throughout the study project. The availability of such automatically accumulating data is probably one reason for the present danger in the study of web-based learning, however: The temptation to start with these data may lead the researcher into leaving other sources of information unexplored. This is unfortunate for the following reasons. Despite the fact that much information can be traced from the data files, it shows only a small portion of student activity. Looking at mere web-work also provides a narrow and, maybe, distorted, perspective to what from the students' or other participants' point of view seems central. An ethnographic approach (Hine 2000, Kuure et al. 2001) to virtual interaction, which utilizes multiple sources of data, helps to reach the participant perspective.

Although it should be clear for researchers in educational and humanistic fields that human activity and learning are too complex foci for researchers to draw direct conclusions about success or failure in the activities concerned, it seems that in the hype of the expansion of new technologies in pedagogy we easily forget this and rush to accept our first interpretations of our analyses, often with a single source of data. In other words, we as researchers and teaching practitioners should carefully consider to what extent it is possible to make generalizations concerning the effects of technology on learning outcomes.

Data collected in 1998	**A. Video and audio recordings of communicative situations**	Collaborative work at the computer.	Videoconference situations.	Peer interviews.	
	B. Written data	Discussions (342 postings, 25 threads)[1] in the asynchronous international web-conferencing environment (COW, conferencing on the web).	E-mail correspondence between the teachers and co-ordinators of the international web-work.	Pre- and post-collaboration questionnaires.	
Data collected in 2000	**A. Video and audio recordings of communicative situations**	Collaborative work at the computer.	Videoed classroom situations (ten 90-minute sessions in two different groups) and one videoconference.	Reflective discussions between the teacher of the course and the participant observers after the classroom situations.	
	B. Written data	Discussion (476 postings, 38 threads) in the asynchronous learning environment (ProTo) complemented with data-base logs for identifying when a particular posting was accessed and by whom.	E-mail correspondence between the teachers and co-ordinators of the international web-work.	Unstructured participant observation notes.	Written documents produced by the students in the classroom situations.

Table 1: Data in the SHAPE project

We wish to emphasize the importance of critical and careful consideration of research approaches and of pedagogic implications concluded from research on web-based learning and teaching. Hine (2000) suggests that instead of looking at the technology as an agent (i.e. the effects of technology on learning outcomes) we could turn our attention to everyday practices around the Internet and how it is negotiated in the local context of its use. In our project, we are interested in having a look at how Internet-based learning tools are used by the students in their studying projects and what kinds of meanings they attach to these tools. Trying to reach the participant perspective helps us in understanding more deeply the phenomena of web-based learning. This helps us to make more informed decisions in terms of pedagogy.

The pedagogical framework

With the emergence of the socio-cultural (cf. Lave & Wenger 1991) and socio-cognitive (cf. Resnick, Levine and Teasley 1991) theories of learning the importance of learning interaction is further emphasised. Interaction is seen as a vital element of all human learning. Finding pedagogical solutions, which support meaningful learning interaction is a challenge, however. The SHAPE-project is interested in studying both the pedagogic models for the web-work and related face-to-face classroom situations.

The web-work started with topic building. The topics were formed in classroom discussions together with the students and the teachers, aiming at finding the problem areas which the students find meaningful and the relevant learning theoretical concepts to describe these, thus developing a common language for the learning

[1] The total number of postings in the COW environment, which consisted of two parallel conferences, was double in size. The analyses of the web discussion concentrated on the case-discussions produced in the conferencing area reserved for Finnish students.

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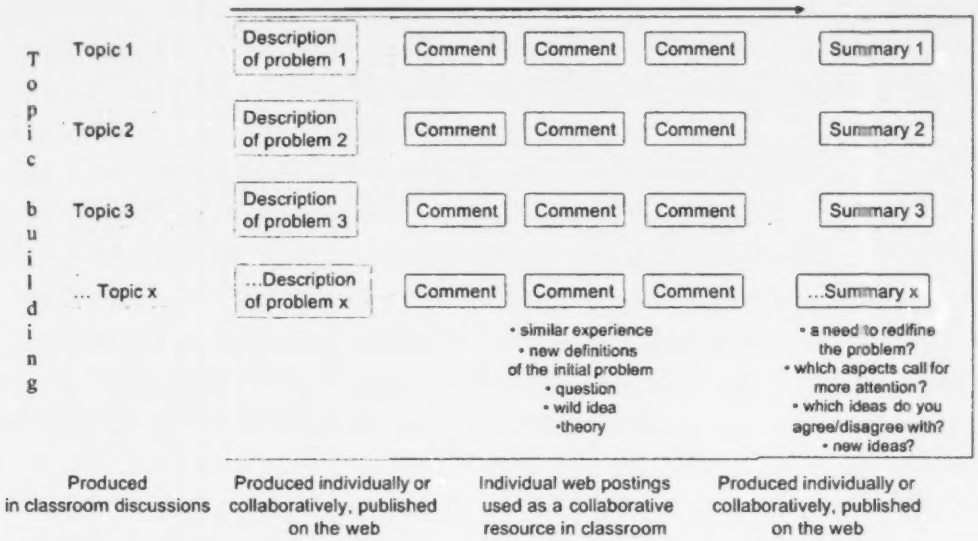
community[2]. Topic building was followed by writing case descriptions. The teacher students in the different sites were asked to produce description of problematic instances they had met with while teaching or studying, and post these to the web-environment. During a period of approximately two months, these problems were then discussed in the international learning community. Towards the end of the web-work the students wrote a reflective report based on the discussions around their problem.



Picture 1: Case-conferencing model

To support the web-work, several strategies were used to bring the participants' views and work into the foreground and, thus, make it accessible for reflective discussion (metawork). First of all, the local groups met regularly face-to-face even though the focus of the work was on the web. The sessions (ten altogether) took sometimes place in the computer class and sometimes in a lecture room.

In the computer class, the function of the meeting was to let students work on the web, and, simultaneously, provide tutoring in technical questions, linguistic and stylistic issues as well as content matters. The students worked in pairs at the computer, which was a conscious choice from the perspectives of both pedagogy and research methodology (cf. Silverman 1993): In such a situation, the working partners tend to explicate their problems and questions in speech to each other, which makes it easier for the teacher to observe the need for individual tutoring or joint elaboration of thoughts. Moreover, the data gained through this kind of methodology emphasize the interpretations of the researched, rather than impose the researcher's categories on the phenomenon under scrutiny (Cameron 1993, Alasuutari 1995).

In other classroom meetings during the web project, the focus of the work was on group dis cussions and shared workshop-type elaboration of issues brought up by the students and facilitated by the teacher. The activities of these sessions yielded from deciding on the topics of the web conference to writing diplomas for the group. As the course in the Finnish universities covered English as a foreign language, the theme of academic writing and features of asynchronic communication in a foreign language also occurred frequently.

[2] For example, in the year 2000 the topics consisted themes such as "building learning communities" or "thinking, understanding and knowledge construction".

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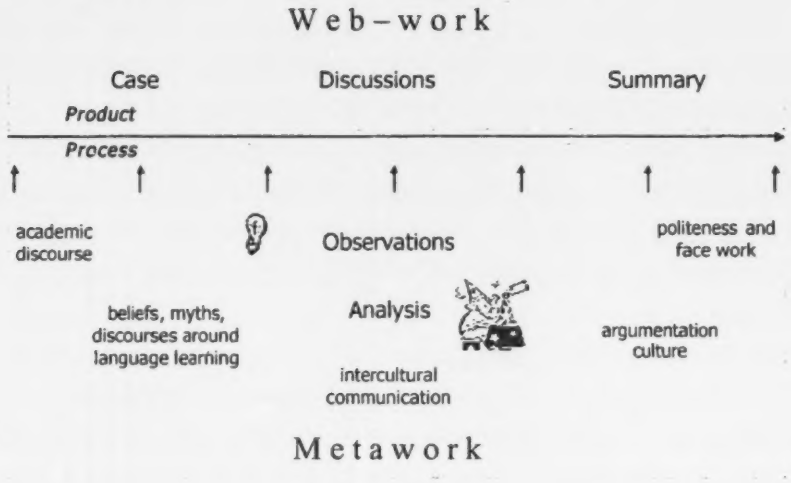

Picture 2: Metalevel analysis of the web-work as a tool for language learning.

As was pointed out above, metawork appears to be an essential aspect of learning support which despite a long tradition of research and teaching method development on awareness (cf. Van Lier 1995) still needs attention. Therefore, special attention was paid to the teacher approach on the course, not only on the web, but especially in the accompanying face-to-face meetings. It is well known that traditional classroom discourse patterns tend to persist despite genuine attempts by teachers to assign power and initiative to their students, and, indeed despite their students' eager efforts to accept the challenge. Similar observations were made by Silverman (1997) about interactional dynamics in counselling sessions. In order to break the persistent patterns of pedagogic interaction, a teacher approach was adopted that could be described as consultative. This means that in the face-to-face meetings the teacher consciously avoided taking initiative in the discussion until it was certain that even the quieter students had had a chance of sharing their observations about the web work with the whole group. The observations were elaborated in the group by the help of the teachers and the two participant observers with their theoretical and practical perspectives (see Picture 2). The observers were members of the research group, and experienced teachers, who were present in the classroom meetings. In addition to taking notes they were also "legitimate" participants occasionally engaging themselves in the collaborative analysis of the student observations, and, thus, supporting the teacher as a consultative facilitator. This work was demanding, and therefore also reflective discussions between the teacher and the participant observers were arranged after the classroom situations. These were recorded for research purposes.

Conclusion

In the SHAPE project, we have for some time developed methods for catching the interactional dynamics inside and outside web-work and the student experience about it. The research method and the pedagogic approach have been developed hand in hand. In fact, the cyclic process of involvement in and detachment from the action itself, i.e. switching between particpation and observation, characterizes both our research and pedagogic approach.

Students do not necessarily judge the focus and scope of learning in the same way as teachers. Neither is it always easy for them to see their own achievements easily. This may be especially difficult in the case of web-study as the students do not have the support of their peers at hand to strengthen self-confidence and confirm their interpretations of the goals of the work, for example. Moreover, in case of uncertainty, web-study does not make situation-sensitive construction of meanings possible when necessary. In face-to-face classroom situations, an abundance of interactional means (e.g. gaze) are available to intensify the bonds between participants. Therefore, even though a central point of our research is in interaction and learning in virtual environments, we have focused more attention in this paper to discussing the nature of face-to-face meetings accompanying the web-work, and,

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especially, metawork. We consider this as a necessary and positive bias both from the point of view of pedagogy and research in the field. Only by looking at the wider contexts of learning projects we may understand more thoroughly how students perceive learning and work in virtual environments - how they interpret web-work and what it is that seems meaningful for them.

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A Learning Information Analysis System for Teaching Japanese as a Foreign Language

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Abstract: Students of Japanese have, of late, come from a variety of different backgrounds. They bring their own particular culture, knowledge of Japanese and ways of learning to the study of the Japanese language. As a result, students may experience unique problems in learning Japanese and require specialized teaching materials that suit their needs. In Japanese universities, however, teachers cannot develop strategies to meet these needs, because the curriculum is textbook-based. In such a system it is difficult for teachers to assess students' needs and to facilitate learning. Therefore, we have developed an information analysis system to facilitate effective teaching and students' self-directed learning.

A supervised Program for Cognitive e-Training

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Abstract: The aim of this paper is to present an adaptive web site, called HAPPYNEURON, dedicated to the supervision of cognitive etraining sessions. This program is based on the cognitive user profile generated and exploited during the training process. The supervisor suggests some exercises and adapts its comments according to this profile. The profile components are mostly performance indicators which belong to the five main cognitive sectors: memory, attention, executive functions, language and finally visual and spatial representation.

Introduction

Aging often goes with memory deficiencies, but if the brain is regularly trained, the decline of memory may be slowed or delayed. Unfortunately, daily life does not offer enough varied situations to stimulate all the functions of memory. All people do not use their memory in the same way : some are excellent in expressing themselves or remembering a conversation, others will be better at recognizing faces or memorizing an itinerary. These differences are normal, and reflect the individual personalities linked as much to education as to curiosity.

When you realize that you forget things, or that your analysis skills are not as sharp as before, you should, of course, see a doctor about it. But you may also practice on some exercises. Can you improve your memory ? This question can not be answered simply.

Memory is not a muscle that you could just "swell" by learning poetry all day, or playing bridge seven times a week. Scrabble® and crosswords only reinforce the very old memory of word spelling and meaning. Bridge only uses memory of game techniques learnt long ago. Learning poetry will only improve poetry memory, not the kind of memory that enables you to remember a date, or where the keys are. On the other hand, these activities enable you to keep your sagacity as they are achieved with pleasure and are user-friendly.

Daily activities, especially for people who retired from an intense professional life, are not sufficient to stimulate brain activity. It is highly profitable to practice daily activities which exclude routine, and reasonably challenge the brain. This is the objective of the training exercises proposed on the happyneuron.com website we built in collaboration with SBT (Senior-Brain-Training) company. This site proposes games to train the cognitive functions, as well as pages of medical information, aimed at a senior audience. It offers a **personalized cognitive e-training** service.

As everybody knows, users are a diverse population varying in knowledge, skill, interests and learning style. This makes the designers often face the challenge of providing personalized services. To address these requirements, researchers try to build user models (Benaki et al., 1997) (Newell, 1997). Usually, the user model holds pieces of information dealing with the user's preferences and characteristics. According to this model, the programs can adapt their service to the user. In the case of educational programs, the teaching is adapted to the learner model, which mainly relies on his/her knowledge (Berry, 2000). The originality of our work relies in a cognitive profile that complement the other model. The user executes a set of various exercises proposing several difficulty levels,

versions or durations. His/her performances are archived and longitudinally monitored. Thanks to the cognitive profile, the system dynamically advises the user in the choice of exercises and their options.
In this paper, we first overview the supervised program for the cognitive e-training, then we describe how to generate and exploit the model components, and we conclude with the supervision process according to these components.

Cognitive abilities

Cognitive abilities are equivalent to the mechanisms which allow humans to, firstly, recognize and acquire information, to express them into representations then into knowledge, and finally to use them for the generation of more or less elaborated behaviors (Lemaire, 1999). Cognitive psychology describes the mental functionality in terms of interactive and independent systems or modules. The real architecture of a cognitive system is not known yet, nevertheless it is possible to distinguish a set of sectors depending on: the type of information, its presentation and the aroused behaviors. Cognitive abilities vary from a person to another, or even, for the same person, from one moment to another. These abilities are mostly and progressively influenced by age.

Memory is the set of mechanisms responsible for : acquisition, storage and finally re-use of information. It is not a unitary function, it is divided into different sub-systems according to :
- The learning or reminder nature (conscious or unconscious),
- The type of strategy employed (verbal or visual),
- The quality of memory stored (personal experience, cultural facts, specialized and motive procedures).

Attention is fundamental in intellectual efficiency, it is requested in the majority of cognitive tasks. In some cases, the attentional resources mobilization allows either the favor of a stimulus among others or, at the opposite, the concentration distribution and simultaneity over several surrounding areas of stimuli. Working memory is a specialized form of attention, which temporarily stores information allowing the execution of cognitive activity in progress.

Language brings together the set of expression processes and understanding according to two codes: oral and written. It constitutes the most important communication means of an individual who has modules monitoring sounds, spelling, word meaning, grammatical progression, comprehension procedures and speech organization.

Executive functions correspond to more elaborated functions such as:
- functions of logic and strategy,
- mentally adaptable nature and planning function,
- problem solving and hypothetical deductive reasoning.

The visual and spatial domain deals with pattern recognition and identification systems as well as the analysis procedures of several shape positions. It also allows the re-use of mental manipulation of shapes like spatial rotations.

Cognitive e-Training Program

This project was born from a noting about the e-learning systems. In fact, in such systems, the user is confronted to lessons, exercises, games etc, which, on the one hand are relevant to his/her needs and preferences e.g. educational level, domain knowledge (expert or novice) but on the other hand, do not take into account his/her abilities for assimilation, memorization etc, which are parts of the cognitive abilities discussed above. In some cases, the learner gives up the game or the exercise because of the frequent situations of defeat. In other cases, he/she tries hard to make their best in order to avoid these situations which overload their abilities. Our project has taken these failures into account and tried to complement the e-learning technologies with the e-training ones. Its aim, as mentioned above, is to regularly stimulate cognitive abilities in order to maintain them in a high level of performance as long as possible.

In collaboration with the SBT firm, we have designed an interactive web site for supervised cognitive training. This site has been available since May 2001 (www.happyneuron.com). During each training session (e.g. each connection), the user executes a set of 3 or 4 exercises. He/she can choose them in a catalog or follow the recommendations of the system. Exercises are presented with a playful and cultural dimension, and vary in difficulty level, speed... in order to entertain the user. Moreover, the exercises use semantic data, i.e. words, pictures... The following snapshot shows some of the interactive exercises.

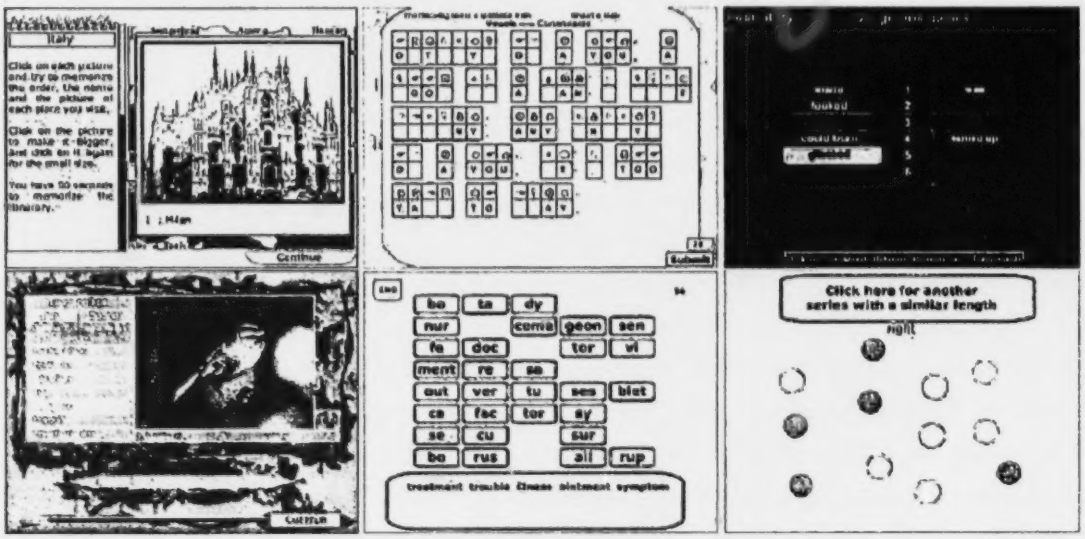

Figure 1: Some interactive exercises

The Approach

The User Profile

In order to give adapted advice, the supervisor builds a user model with 4 types of information:

- Social and demographic data (Brusilovsky, 1999) that the system knows from a questionnaire, i.e. age, gender, profession ;
- Thematic tastes (music, drama, etc.) which are initialized by the questionnaire and modified according to the choice made by the user during his training process;
- Behavioral data that the system deduces from the behavior of the user;
- Cognitive indicators related to performances obtained after the exercises were run.

This model is updated by applying a set of rules we will discuss below. The first and second types of information are not detailed in this paper as they represent general data easy to understand, whereas the third and last one are more important to our model.

The supervisor analyzes the user's task towards some services such as his/her profile details, the history of performance... So the supervisor observes the user's actions in checking these pages. It determines the degree of motivation of the user by observing, for example:

- how many times the user gets connected on the site;
- whether the user follows or not the supervisor's advice...

These data must be carefully held. Today, it is only used by the supervisor to determine the ratio of exercises that train the user's strong and weak abilities for his/her advice.

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The main innovative part of our model is the cognitive profile of the user. This profile is composed of cognitive indicators dispatched into 5 sectors: *memory, attention, executive functions, language and visual and spatial capacities*. Finally, 25 indicators have been determined among which: cultural memory, old personal memory, recent memory (verbal, visual or musical), working memo ry and short-term memory (verbal, visual or musical), lexical spelling, categorization, understanding, arithmetic, planning, strategy, reasoning, mental imagery, form recognition, etc.

Thanks to these indicators, we can model the cognitive sectors that are most solicited while performing an exercise. However, in practice, an exercise cannot imply a unique sector. Every cognitive activity results from a parallel or hierarchical processing of a lot of cognitive abilities. For each exercise, we have determined the different solicited indicators and chosen weight factors ($0 \leq p_i \leq 10$). After each exercise is played, the performance (P) of the user is computed using the average performance (M) and the standard deviation (σ) of this performance that are stored in our database and result from other users which have the same characteristics (age, gender and level of education).

The formula looks like : $S = 50 + 20 \times \frac{P - M}{\sigma}$ The score is then constrained between 0 and 100.

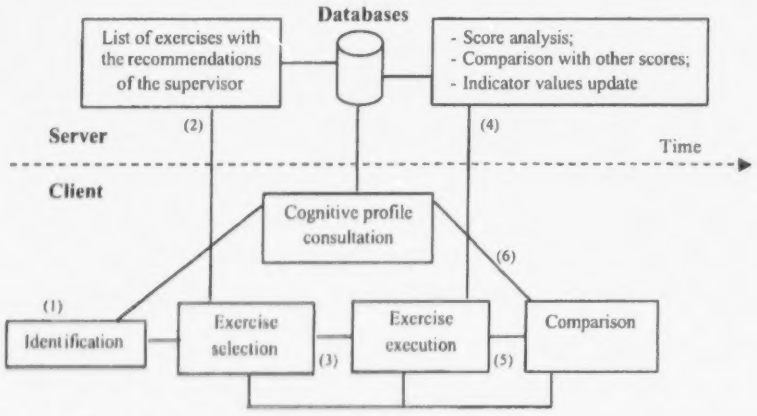
Someone with an average performance will obtain a score of 50 (the default value) and someone with a very good performance of $M+2\sigma$ will obtain 90 (2,5 % of the population). This score then changes the cognitive profile, i.e. the indicators implied in the exercise. The updated indicators ind_i are the result of a weighted mean between the old value and the new one. The cumulated weight value Cp_i is limited to 100 in order to limit the contribution of the oldest values:

$$ind_i \leftarrow \frac{p_i \times S + Cp_i \times ind_i}{p_i + CP_i} \qquad Cp_i \leftarrow Min\,(p_i + CP_i,\ 100)$$

Training process

For each connection, the supervisor suggests a set of three or four exercises. The user can also select other exercises in the complete list. At any moment, he/she can:

- check his/her performance by consulting *the profile performance* page,
- have a summary of the exercises he/she has already done (fig 2),
- browse some documents (news, forum,...).



(1) User identification followed by the proposition of exercises according to the model.
(2) Exercise selection according to the difficulty level that the supervisor recommends for the user, this step is followed by the execution of the exercise (3).
(4) Actions capture and score analysis. The averages, which are calculated, are weighted (i.e. indicators have different weights).
(5) Comments on the exercise and score comparison.
(6) Executed exercises summary check.

Figure 2: A session of cognitive e-training.

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Supervision process

For every connection, the system suggests a set of four exercises according to the user's profile. Among dozens of exercises, the selection is performed thanks to the activation of a set of rules, of which the three most important are:

- *Rule 1*: select the exercises that are most adapted to training the weakest indicators of the user, combining the user's profile and the profiles of the exercises (weights of indicators);
- *Rule 2*: select the exercises which have not been performed for a long time (in order to ensure the variety of exercises);
- *Rule 3*: select the exercises that are most adapted to training the indicators of the user which have the lowest cumulated weight in order to be sure that he/she trains all cognitive sectors.

For each selected exercise, the supervisor recommends an exercise variant among the numerous possibilities (between 1 and 50 depending on the exercises). Thus, advice is established in two phases (see figure 3). First of all, a theoretical score is computed using the current values of the user profile and the exercise profile. Using two threshold values (50 and 75), the supervisor then determines if it should recommend an easy, medium or hard version. Afterwards, it randomly chooses a version that has been classified in the correct category.

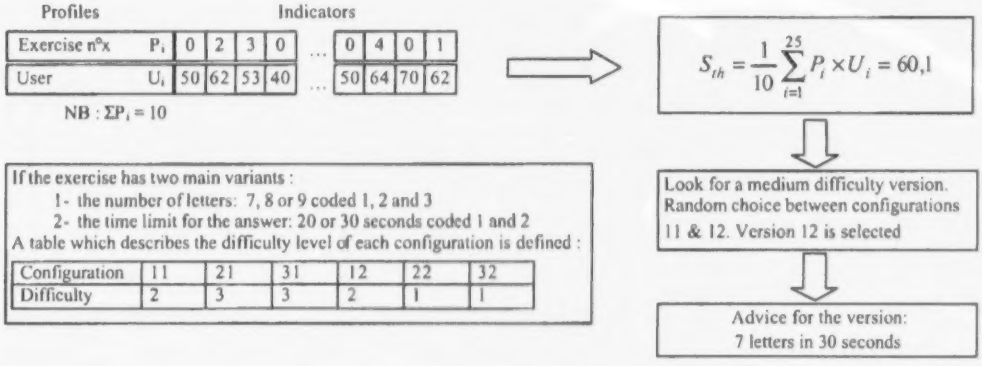
Profiles
Indicators
Exercise n°x P_i 0 2 3 0 ... 0 4 0 1
User U_i 50 62 53 40 ... 50 64 70 62
NB : $\Sigma P_i = 10$
$S_{th} = \frac{1}{10}\sum_{i=1}^{25} P_i \times U_i = 60{,}1$
If the exercise has two main variants :
1- the number of letters: 7, 8 or 9 coded 1, 2 and 3
2- the time limit for the answer: 20 or 30 seconds coded 1 and 2
A table which describes the difficulty level of each configuration is defined :
Configuration 11 21 31 12 22 32
Difficulty 2 3 3 2 1 1
Look for a medium difficulty version.
Random choice between configurations
11 & 12. Version 12 is selected
Advice for the version:
7 letters in 30 seconds

Figure 3: The algorithm that chooses a version of an exercise for a personal coaching.

Performance notification

After each exercise is run, the user can watch his/her scores (fig. 4). To evaluate the performance, the user can ask about the other results and some comments in order to determine his position compared to the average score and the standard deviation of other compatible users (which belong to the same profile).

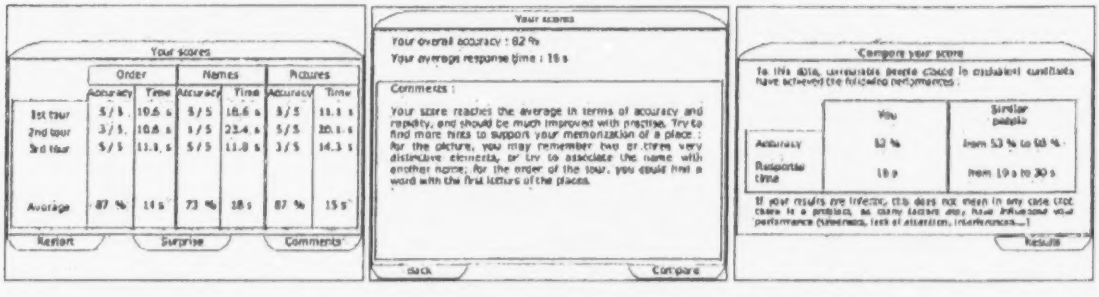
Your scores
Order
Names
Pictures
Accuracy
Time
1st tour
2nd tour
3rd tour
Average
87 %
Restart
Surprise
Comments
Your scores
Your overall accuracy : 82 %
Your average response time : 16 s
Comments :
Your score reaches the average in terms of accuracy and rapidity, and should be much improved with practice. Try to find more hints to support your memorization of a place : for the picture, you may remember two or three very distinctive elements, or try to associate the name with another name; for the order of the tour, you could find a word with the first letters of the places.
Back
Compare
Compare your score
You
Similar people
Accuracy
82 %
Response time
16 s
Results

Figure 4: The sequence: personal results, comments, and comparison.

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A special care is taken for the wording of each comment and for the presentation of the performances of similar people. A large scale [M-2σ, M+2σ] is used in order to show that the important thing is to estimate one's own performance and the possible progressions.
For each sector, the user can have a static vision of his profile. This profile is synthesized in the five sectors. (fig 5). For each sector, a longitudinal presentation is available to inform the user of his evolution during the training process).

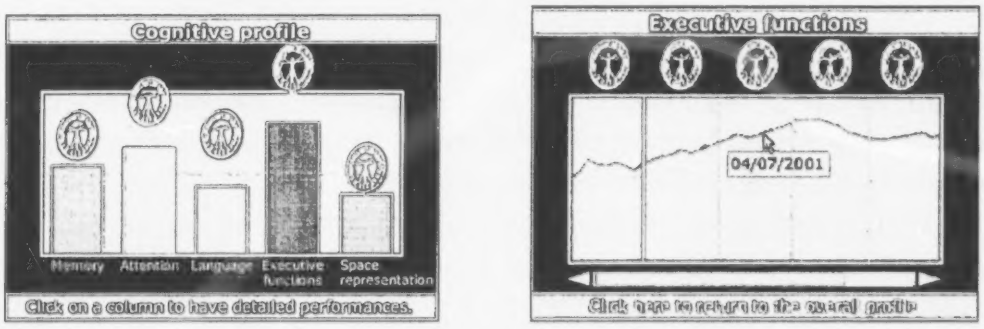

Figure 5: User profile for the five sectors and user evolution for the sector 'Executive functions'

Conclusion and Future Work

In this paper, we have presented a user cognitive model generated and exploited in an interactive cognitive training system. This model combines 4 different types of information: demographic data, thematic inclination, behavior and cognitive indicators. The last model is very innovative and it can be used in many other situations. It contains 25 indicators that characterized the cognitive profile of the user. This profile is generated thanks to the execution of several exercises. The definition of this model and the design of the supervision process of e-training were possible by adopting a multidisciplinary approach i.e. computer science, cognitive psychology and neuropsychology.
Our exercises can be used in complement to classical courses centered on knowledge. They develop meta-cognitive abilities that are very important in learning activities. We already have adapted some of them for children and it is obvious that they could complete e-learning resources.
In our opinion, the cognitive user model we developed can be used not only for adapting the system we described above, but also for other systems. The first possible alternative application could be to improve the techniques used by adaptive interfaces. They would then choose better modalities in hypermedia documents (such as putting the stress on sounds rather than words a better understanding). To this date, we have defined the first working track, and other experimental works of validation are in progress.

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A university web-based support structure that addresses preparation of quality teachers: Applying technology to support mentors and supervisors of teacher candidates and beginning teachers

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Abstract: Technology can be a key tool for connecting individuals when time and schedules interfere with their need to communicate. These forms of communication can take the form of on-line chats that include a class of individuals or single consultations with one individual. Other enhancements that can be added to the mix include sound and video capabilities that would allow supervisory/mentor teachers to practice using different observation formats and receive feedback on their work. Selected readings that address needs and interests can be made available on-line for individuals to read, reflect, and respond to in on-line reader response sessions. Assistance, monitoring, and feedback can be provided on an on-going basis as cooperating teachers encounter dilemmas or need ideas for how to engage an intern in assisting and teaching the students in their classes. These are examples of "support structures" that can be provided via technology to assist cooperating teachers in their roles. The poster session will illustrate how these integrate into web-based professional development opportunities for cooperating teachers that are being developed collaboratively by a graduate school of education at a metropolitan university and representatives from a network of professional development and partner schools across six school districts.

Engineering Design Tutor

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Abstract: Incorporating technology into a student's learning greatly benefits students' understanding (Bazillion & Braun, 1998, Grossman 1999). We have developed a new software system called Engineering Design Tutor (EDT) that can generate any number of multi-step problems with minimal amount of input from the instructor. The EDT is able to generate problem sets that include problems illustrating the same set of concepts or problems that demonstrate a number of different concepts. New problems can be generated dynamically, thus allowing for self-paced, competency-based approach to evaluating student's performance in a design course.

With the implementation of the Engineering Design Tutor, all student interactions with the design problem sets will be electronic via computer. By adopting standard Internet technology, the EDT can be used at other institutions or to support distance learning. The attendant increase in the size of the target audience creates vastly improved potential for cost reduction.

Introduction

In the domain of engineering, one of the main subjects that students learn is design of components or systems specific to a field of study. Practical engineering design is intuitive, and a successful engineer needs to have an intuition based on the understanding of the basic ideas of the behavior of the engineering system and the experience of having designed different systems. The only way a student can develop this intuition for various aspects of engineering design is by a drill-and-practice mode of learning, i.e., working on numerous similar problems. Usually it is the responsibility of the course instructor to set up assignments for the students and give feedback in the form of checked or graded work. The instructor has to develop a set of problems that challenge and reinforce the concepts covered in the class and then gage the level of understanding gained by the students based on their response. Unfortunately, because the procedure for solving a design problem often involves multiple steps illustrating various design concepts, the task of solving, checking and generating new problems by hand is highly time consuming. With computers having become an integral part of a student's life, it is now possible to develop an automated electronic system that supports the process of teaching engineering design.

Requirements for the Engineering Design Tutor (EDT)

There is a clear need for a computer-based tutoring system that automates the drill-and-practice mode of learning for engineering design. Since this routine training method is common to several engineering domains, it is useful to have a general framework that can be adapted for different domains. Therefore, the central requirement or feature of the EDT is a *problem generator* capable of generating a number of different problems testing the same set of design concepts. By automating the process of problem generation automatic, such system enables the instructor to assign

problems to the students based on their needs and provides significant benefits for both the instructors and the learners.

Instructor's benefits:

- The system reduces the burden of the instructors by transferring the problem set generation to the newly designed EDT architecture
- The system greatly reduces the amount of time spent in grading students' work
- The problem generator overcomes the difficulty of customizing a problem set for the ability of individual students. The instructor can test the students for competency by using "custom homework". This means that the system will continue to generate problems for students till they demonstrate their understanding by solving a problem correctly.

Student's benefits:

- The tutoring system helps students to improve their understanding of the design concepts and to hone their design skills by exposing them to large sets of similar problems.
- The system enables self-paced learning. If a student is not confident about a particular concept, the system can provide examples with solutions and also several problems that the student can use to test his/her understanding.
- The system will ensure that the students' performances are evaluated quickly thereby reducing the delay in providing feedback to them.

While existing computer coursework environments such as WebCT (Goldberg et.al. 1996) and CAPPA (Kashy et.al. 1995) include testing modules that can claim similar benefits, their testing methodology is limited to single-step multiple-choice problems. As a result, it is most useful for introductory courses that are able to reduce their problems to cover only one concept at a time. The ability of EDT to generate and grade multi-step problems allows these benefits to be extended to students taking upper level courses that require the solution of multi-step problems.

In addition to the key feature of automated generation of multi-step problems, we felt that to ensure wide usage of the system we need to incorporate the following features in the design of the EDT system:

- The software should be easily accessible so that the students can access the system at any time from anywhere as best suits their needs. Some students may spend less time solving the problems while others may have to work on a lot of problems until they are confident about a particular design concept. An easily accessible electronic system will also enable students to pace their study as required thereby making individualized attention possible.
- The architecture of the EDT software must be flexible enough to enable it to be used for different applications and domains with minimum modifications. An architecture that is transferable to other applications would greatly reduce the cost of building new tutoring systems for each domain. Also a flexible system would enable new features to be added easily without affecting the structure or design of the system.
- The computer-based system must be able to support a large number of users thereby allowing instructors to have more students their classes. The ability to scale the prototype for a larger user base would multiply the savings and benefits of the EDT system.

Recent computer and information technology developments eliminate technological barriers for building and incorporating the above features in the system.

The EDT Architecture

Figure 1 provides a general overview of the EDT system. The EDT system supports two types of users, instructor and students. Instructors use the EDT system to generate customized homework that tests the students on routine engineering design problems. The students use the system as a problem server to solve as many problems as they want and demonstrate their understanding of the design concepts. Because the drill-and-practice mode of learning is common to several engineering design fields, the EDT is designed as a general framework that can support multiple domains.

The system uses the Internet as the communication protocol for instructors and learners to access the system. The near ubiquitous availability of the Internet in college campuses makes it possible to provide unlimited access to a tutoring system from a wide variety of locations. As a result, computer access is no longer an impediment to the student. By using the WWW browsers as the user interface, the tutoring system can be run on a wide range of computing platforms. The Internet also allows the system to be used by students at geographically distributed locations. Hence, the user base for these systems can be extended to encompass a large set of students from various institutions, thus enhancing the ability of the tutoring system developers to recoup the development costs by promoting wider dissemination.

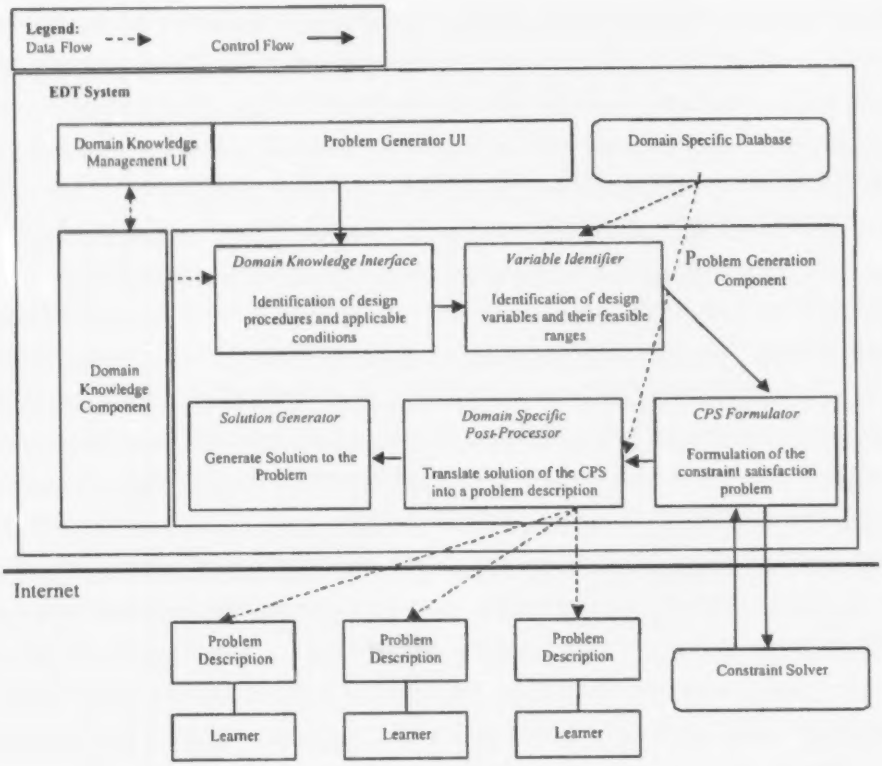

Figure 1. EDT System Architecture

The architecture for EDT separates the knowledge needed for problem generation into two main categories:

- domain knowledge that captures information about various concepts used in design; and
- problem generation knowledge that operates of the domain knowledge to create design problems and to produce the corresponding solution.

This approach simplifies the process of ext ending and modifying the knowledge in the system and allows the creation of problem generation knowledge that would be independent of the domain to which it is applied. The separation of domain knowledge from the problem generation knowledge is reflected in the software architecture of EDT that consists of two main components: domain knowledge component and problem generation component.

Domain knowledge component

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The domain knowledge component is a module that stores the logic imbedded in the design procedures for a specific domain. The domain knowledge in engineering design is the set of requirements prescribed in a standard and their applicability conditions. The domain knowledge component provides a representation for this knowledge that is rich enough to capture all aspects of this knowledge yet is easy to author, modify and maintain. Because we intend for the EDT to be applicable to multiple domains the domain knowledge component must support representations that are general enough to be applicable across domains. The domain knowledge component also have to provides a management interface that allows the instructor to manage the domain knowledge of a particular field by providing facilities to enter, modify or delete information.

The domain knowledge in routine engineering design often consists of the requirements and their applicability conditions as documented in a design standard. The Standards, Analysis, Synthesis and Expression (SASE) methodology (Fenves et. al. 1987) has been widely used to represent design standards in Civil Engineering design domains and has the required characteristics of clarity, ease of use, rigor and richness. As a result, it was chosen as the representation for the domain knowledge in the EDT.

The two main elements of the SASE representation are data items and decision tables.

Data Items

A data item or datum is any represents a design variable. Each variable generated by evaluating a formula. All data items in an engineering domain can be divided into two categories. All variables references by other data items but not explicitly assigned a formula are called *input* data or *basic* variables. The rest of data items are referred to as *derived* data items.

Decision Tables

A decision table is a structure that is used to represent the rules for calculating or evaluating a derived data item. It defines a set of rules by specifying which formula should be used to assign a value to a derived data item. The formula is chosen based on the values of a specified set of conditions and hence is an orderly representation of the reasoning leading to a decision. A decision table is composed of conditions, actions and rules. A condition is a logical statement that may have one of the two values: true or false. An action is a formula that assigns a value to a variable. The rules are used to match a set of condition values to an action.

The use of SASE methodology to represent design concepts by decision tables ensures the following qualities:

- Ability to ensure the completeness and correctness of the concepts defined in a domain.
- Ability to explicitly define the connections among different concepts
- The ability to determine the sequence in which the concepts need to be evaluated
- Ability to ensure that concepts defined in a domain do not have repetitions or loops in logic.

Problem generator component

The problem generator component is the module that generates problems based on the instructor's specifications. The problem generator user interface of the EDT serves as a means for the instructor to communicate with the system. The instructor begins the process of identifying the type of problem to be generated by selecting a set of concepts that a problem must contain in its solution. The generation of problems is done by the following sub components:

- *Domain knowledge interface*. The problem generator component analyses the domain knowledge of the system through the domain knowledge interface and identifies the set of data items and decision tables corresponding to each design concept. Since the evaluation of data items and decision tables may require the use of derived items not in the initial set of concepts, this component identifies all concepts that would be required to formulate a problem that includes the initial set of concepts identified by the instructor. In addition, this component used the information from the domain knowledge to establish the precedence relation between all data items.
- *Variable identifier*. The variable identifier component processes the concepts and relationships identified by the domain knowledge interface and extracts a list of input and derived variables. It also then queries the domain

specific database to obtain the feasible range for all of the input variables and allows the instructor to further constrain the possible values for the variables.

- *CSP formulator*: In many design examples, the formula used to compute a value of a derived variable is determined based on values of other variables. This logic is represented using decision tables and stored in the domain knowledge database. In order to ensure that the generated problem includes the concept defined by the instructor, the decision tables' logic is reformulated as a set of constraint. The task of problem generation is thus reduced to finding a solution to a constraint satisfaction problem (CSP) created by the CSP formulator. The solution to the CSP is obtained from an external constraint solver. We use interval constraint solvers (Hickey 1998) for CSP since we are interested in calculating a range of possible input values. The ability of interval solvers to produce range limits on variable values allows EDT to generate more than one problem with similar solution.
- Application specific post-processor: The problem generator uses an application specific post-processor to translate the CSP solution to a problem description. The solution to the CSP provides a range of variable values that satisfy the constraints and hence multiple problems can be generated by the system. Formulating a problem description involves using a standard problem template and plugging in values for different variables from the CSP solution. This component is the only domain-specific component of the problem generator and is the only component that would need to be re-coded to extend EDT to handle new domains.
- Solution generator: The solution generator module uses in problem statement and the solution logic imbedded in data items and decision tables to generated the step-by-step procedure for solving the problem. The students can use this to solution to check their values and get explanations for any error in their solution.

Distributed Component Architecture of the EDT

In order to ensure the extensibility and scalability of the EDT, it is implemented as a distribute component application and is built using Java-RMI (Java-RMI) distributed component architecture. The benefits of this approach to developing educational software have been described in (Roschelle et. al. 1998, 1999).

Fig 2 shows the distributed software components of the system. Each component represents a related group of functionality and provides separation between the domain and problem generation knowledge and between the generic and domain specific functions of EDT.

The database server and the problem generator are the two main servers in the system. The user interface is the program the instructor uses to generate problems and it communicates to the servers acting as a client. The problem generator is the server that actually generates the problem description along with the solution. The database server is a component that interacts with two domain databases, the domain knowledge database and a domain specific database. The domain knowledge interface of the problem generator uses this server to obtain the decision table representation of the concepts available in a domain and the definition of all data items. The domain specific database is used by the variable identifier component of problem generator to obtain the feasible range of values for the input variables and to retrieve the domain-specific problem templates. The constraint solver encapsulates the interval constraint solver used to bound values for input and derived variables during problem generation.

The decision table representation of the standard in a database, the database and problem generator server, the user interface program, and the interval arithmetic solver are all implemented as independent components, and can be distributed across a network. This approach makes the software scaleable, flexible and reusable for a variety of needs. The system can easily support different engineering domains, because only application specific post-processor module of the problem generator server has to be re-implemented to support the new domain. In addition, as the capabilities of interval servers improve, the existing constraint solver can be replaced without affecting the architecture of the system. Finally, this architecture allows automatic updating of domain knowledge. For instance, any changes that the instructor makes to the concepts in the domain database are immediately available to other components and to all users regardless of their location

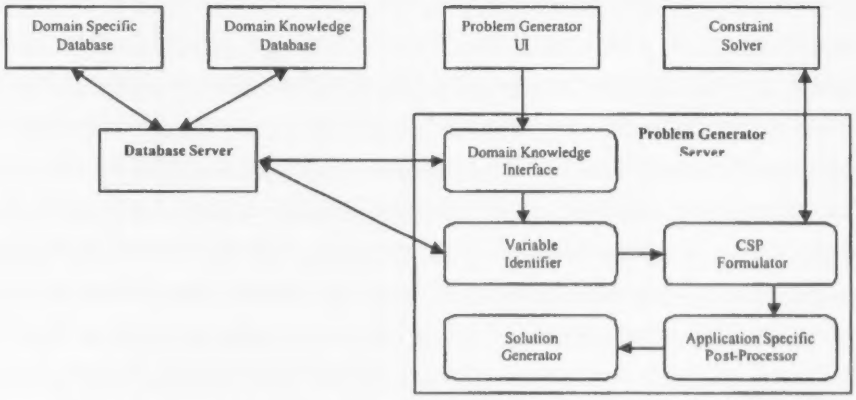

Figure 2 Software Architecture of the EDT

Conclusions

In this paper we have described a new educational software system called Engineering Design Tutor (EDT). The main feature of EDT is that it provides a mechanism for automatic generation of multi-step problems with minimal amount of input from the instructor. The architecture of EDT takes advantage of the WWW protocols and of distributed component frameworks such as Java RMI to create an educational testing environment that is both flexible to accommodate multiple domains and scalable to support large number of remote accesses from both students and instructors. The EDT architecture has been implemented and is currently being tested by civil engineering students at Rice. A more complete description of the system and a demo of EDT applied to steel beam design can be found at http://edt2.civil.rice.edu/.

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Developing and Delivering Online Courses Using Free Web-Based Resources

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Abstract: Commercially marketed software tools that are used to develop and deliver online courses offer features such as e-mail, bulletin boards, chat rooms, quizzing, testing and grading, calendar, and web space for storing and displaying content. These tools offer online instructors a set of features that can be used to create an active online learning environment in which students communicate with each other and with the instructor. Companies that market such course delivery tools do charge a fee for the use of their software packages.

Introduction

The purpose of this paper is to explain how some of the free resources and services that are available on the web can be used in conjunction with each other to create similar online learning environments. Since there are so many resources available on the web, this paper does not attempt to cover them all. Only a few of the resources are mentioned in this paper. Prior to being included, the resources were informally evaluated to determine if they were suitable for developing active online educational environments.

The different web-based resources that have been evaluated and included in this paper are:

- Web hosting services
- Chat rooms (text, audio and video)
- Bulletin/discussion board providers
- Calendar services
- Grading, quizzing and testing resources

In this brief paper we provide the URLs for a few Web sites that offer free services that educators can use to develop and deliver online courses.

Choosing the Right Web Hosting Service

- http://www.geocities.com
- http://www.freeservers.com
- http://www.homestead.com

Calendar Resources

- http://www.calendar.yahoo.com
- http://www.MyCalendar.com
- http://www.ScheduleOnline.com
- http://my.palm.com
- http://calendar.netscape.com
- http://www.SmartCal.com
- http://www.Excite.com

E-Mail and Mailing Lists

- http://mail.yahoo.com
- http://groups.yahoo.com
- http://www.egroups.com

Web Based Chat Resources

- http://www.Chat-forums.com
- http://www.paltalk.com
- http://www.microsoft.com/windows/netmeeting/
- http://www.chatty.net
- http://www.cuseeme.com
- http://www.thrucam.com
- http://www.onlive.com

Bulletin/Discussion/Message Boards

- http://www.ecircle-uk.com
- http://www.ecircle-uk.com
- http://www.boardhost.com

Grading, Grade Books and Assessment Tools

- http://www.mygradebook.com
- http://www.classbuilder.com
- http://www.uzink.com
- http://www.Quia.com
- http://www.discoveryschool.com

Conclusion

There are some disadvantages to using free resources and services on the web to create online course environments. One of these is the fact that "dot.coms" as web-based companies are commonly referred to, can and do go out of business. This happened at least once even as the authors were trying to write this paper. One of the authors was notified by e-mail that one of the companies that she had subscribed to, while researching resources for this paper, had closed its doors.

If different web-based resources are used, students may have to log in and out many times in order to be able to use various resources. In courses that are developed using commercial software packages, one username and password gives students access to all available features.

Many "dot.coms" survive on advertising. Some educational institutions may have policies preventing the use of web sites that contain advertising. Instructors will have to check with their administrators to see if it is okay to use resources that are sustained via the use of advertising.

In conclusion, the authors think that it is possible to use free web based resources to create viable active online learning environments. The authors have identified a few potentially appropriate resources but encourage readers to identity, evaluate, and select resources based on their own needs and interests.

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Online Learning: An Instructional Platform for the Deaf and Hard of Hearing

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Abstract: The use of text-based online learning allows deaf and hard of hearing students to participate in classes. Online learning that avoids the use of audio information, provides captioning, or supplies a written transcription for that information puts deaf students on an equal footing with their hearing counterparts. The deaf student does not need special assistance that would normally be required in a traditional classroom setting. Using the Internet, people with hearing loss have a level playing field with their hearing colleagues and full access to the academic program. Online learning is not only anywhere, anytime learning, but also anybody.

Introduction

Online learning, or distance learning using the Internet, provides a medium that allows deaf and hard of hearing students in K-12 and higher education an equal footing in their classes without the inconvenience of an interpreter in the middle of the communication. Using the text-based medium of such online instructional platforms as Blackboard, deaf and hard of hearing students can participate without assistance.

The use of Internet-based online learning (OLL) presents faculty and students with multiple opportunities not found in traditional face-to-face (F2F) courses. Using web-based instructional platforms, classes can be run without incorporating verbal communication. Instructors can post course information such as announcements, assignments, documents (e.g., PowerPoint presentations), and grades for viewing anytime from anywhere by their students. A threaded discussion board can facilitate "asynchronous communications (non real-time) where students and the instructor post questions, answers and comments" (Lorenzo, 2000, ¶ 10). Synchronous (live, real-time) text discussions using a form of virtual, text-based chat also can play a role in the class (e.g., virtual office hours, group meetings). For course readings, students can be referred to selected Internet sites or use other Internet-based alternatives such as XanEdu's electronic CoursePacks (http://www.xanedu.com/). Students can submit their work via electronic communication, using e-mail and digital drop boxes.

With the addition of online learning, K-12 and higher education classrooms can morph into interactive "24-7" experiences in which deaf and hard of hearing learners do not need communication help from others. Students communicate with one another and with the instructor through their keyboards, mice, and the Internet, not needing to hear the other course participants.

Why Online Learning?

Online learning offers many conveniences and upgrades for students and teachers over the traditional face-to-face (F2F) class. These advantages include:

- *Anywhere, anytime learning.* No longer is the educational process confined within the four walls of the conventional classroom at a prescribed date and time. OLL permits, even encourages, a form of 24-7 education that provides maximum flexibility. Instructors can teach their OLL classes right from their own offices or even homes. Students can avoid the hassles of driving to the campus and trying to find a place to park by accessing OLL courses from office or home. While it may be frowned upon and discouraged by some employers, students do use workplace computers to connect to their OLL courses, mainly because of the faster Internet connections found in many school and office settings. Even web-enhanced traditional courses, which use OLL to extend the teaching-learning relationship beyond the F2F setting, benefit from 24-7 access to course information and online discussion groups.

- *Increased communication.* OLL provides additional opportunities for student-student and student-instructor interactions. Participants in OLL have opportunities to post and reply to communication threads about course-related topics. Questions get raised and answers debated that might well not have been in the F2F classroom. Shy students, or ones with disabilities such as hearing loss, do not have to worry about speaking up, being called on by the teacher, or having their answers understood. If a question is posed in a discussion board, the student has time to craft a response either directly within the discussion board or first in a word processing program and then copy it later into the discussion board. Web-enhanced OLL allows the teacher to post additional information and create study groups that extend learning beyond the confines of the F2F class. In web-enhanced classes, OLL can necessitate additional time and effort on everyone's part, but the learning is enhanced with the resulting richer exchanges (perhaps more so than many F2F classes) among students and between students and instructor.
- *Heightened awareness of others.* The quick pace and instructional methodology of many F2F classes does not permit students and teachers sufficient time to get to know one another. With the back and forth replies in an online discussion board format over the duration of a course, however, each participant gets additional insights into one another. Information is gained from the written exchanges and additional contacts (teacher-student, peer-peer) among course participants, adding to the quality of the learning. Graduate students can find out about one another, creating more of a bond than exists in a typical graduate classroom where the students rush in from work and flee to their homes directly after class.
- *Time considerations.* Time is one commodity that students and teachers cherish. OLL prevents the telephone tag time-waster with reliance on e-mail and discussion forums. Students appreciate the more immediate access their teacher (if the teacher checks his/her e-mail with regularity). No queuing in the hallway waiting to see the instructor during office hours as OLL provides opportunities for virtual office hours. Instructors and students are at their keyboards miles apart, yet communicating individually or as part of a live, real-time group discussion. However, these communications come at the price of increased time and effort in web-enhanced courses, especially for the instructor who has to reply to individuals and the class over the Internet, as these communications are in addition to the regular F2F class meeting times. Web-based courses can save time or at least not waste time. Web-enhanced courses, while more enriching and beneficial, can add to the time commitment of faculty. But, based on the student response, the extra time can be worth the effort.

Personal Online Learning Experiences

This writer's own experience with OLL started with participating in a six-week training program operated by OnlineLearning.net. This organization manages OLL courses for UCLA Extension online and the University of San Diego (USD) continuing education online. After successfully completing the training program, an opportunity was offered to teach a six-week web-based OLL graduate course, Mainstreaming: Teaching Individuals With Special Needs in the Regular Classroom, for USD. Subsequently, additional mainstreaming teaching opportunities were offered this writer by USD. While the initial course had only 10 students, the other courses have had enrollments in the high 20s.

The mainstreaming courses are primarily for California teachers needing to "clear" their teaching credential by taking the course, which fulfills a state requirement for their teaching certification. Each student has been pursuing a master's degree in teaching. The students represent a wide range of teaching experience, including those teaching full-time for the first time, and an extensive breadth in grades and subjects (e.g., elementary, secondary, Spanish, GATE, band) found in public education. Since the instructor is located in New York State, teaching a California-based OLL course with a three-hour time difference can be a challenge. The asynchronous nature of OLL, apart from the real-time virtual office hours, allows the arrangement to be successful.

OnlineLearning.net uses Blackboard, which its promotion states is an "e-Education enterprise software platform that encompasses course management, academic portal, online campus communities, and advanced architecture allowing easy integration with multiple administrative systems" (Blackboard Inc, 2001). It provides a "skin" or shell that hides the programming underneath so that instructors do not have to do any programming, as they would if they were programming their own Internet sites for instruction.

Blackboard's core features include content management that supports most common file formats in an easy click-and-point process, communication and collaboration tools to support individual and group communications as well as group project work, online assessment and testing tools, and administrative tools

with which an instructor can easily build and manage a virtual classroom. (Rochester Institute of Technology, 2001, ¶ 5)

The instructor merely types, copies-and-pastes, or uploads text into the appropriate sections of the course's Blackboard site. Instructors and students communicate by exchanging replies in discussion board forums or by e-mail. The latter can be directed to specific individuals, mailed to sub-groups, or sent to the entire class from within Blackboard. The instructor has control of settings for the Internet site appearance and contents. Tests can be taken online. The experience for the students has been positive, as judged by their informal comments during the courses and by their formal end-of-course evaluations.

Besides working with the University of San Diego, this writer has taught online classes for Buffalo State College using the Blackboard infrastructure. The first course was a graduate course in educational computing and used Blackboard.com, which is a free service available on the Internet for anyone's use. This was a web-enhanced course as the students and instructor still met in a traditional F2F setting once a week for a semester. The OLL component of the course presented the students and instructor with opportunities as previously outlined. This OLL course was the first one for each graduate student. Again, as with the USD mainstreaming courses, after their initial skepticism, the students were enthusiastic about incorporating OLL into their course, perhaps because the course topic involved educational technology.

After this initial OLL course at Buffalo State, this instructor has taught five other web-enhanced OLL courses, including two for undergraduates, using Blackboard on the college's computer server. As one may or not expect, the quality and quantity of the discussion board forum conversations were higher in the graduate courses, although the undergraduates' discussions were engaging and with merit. The undergraduates enjoyed OLL, but their replies tended to be "short and sweet," while graduate students composed longer replies with more thought and substance. The only consistent negative comments were directed at the slowness of the Blackboard connection that was due to insufficient bandwidth and other technical issues at the college. Such problems are being addressed. Also, this writer is scheduled to offer a web-based OLL graduate course for Buffalo State College in fall 2001. This OLL course will be the first one at Buffalo State to rely on the State University Learning Network (SLN) for the delivery infrastructure.

Online Learning and Deaf or Hard-of-Hearing Students

Online Learning can be termed "deaf-friendly," if an OLL course steers clear of the use of audio information, provides captioning, or supplies a written transcription for that information. A deaf student is able to participate in a text-based online discussion without an interpreter clogging up the middle of the communication. By avoiding non-text information or providing text equivalent information, deaf and hard of hearing persons can be assessed on *what* they say rather than on *how* they say it. Using the Internet, people with hearing loss then have a level playing field with their hearing colleagues and full access to the academic program. Keyboard and mouse input constitutes the mechanism to facilitate communication among students and between students and the instructor. The instructor can post PowerPoint presentations, with slide notes or sans sound effects, onto a website or into a course infrastructure provider for easy anytime, anyplace access.

With text-based OLL, instructors do not have to adapt their instruction for deaf and hard of hearing students. The deaf student does not need special assistance "to become part of a mainstream educational setting" (Kinner and Coombs, 1995, ¶ 4). Time and expense do not need to focus on accommodations since deaf and hard of hearing students are on an equal footing in a non-verbal class. As long as the participants can read and type, no one knows if anyone in the course is deaf or hard of hearing. "Once appropriate access has been provided to the computer...students function as equals in the computer classroom, and their disability vanishes" (Kinner and Coombs, ¶ 5). No wonder that deaf and hard of hearing students feel more involved in OLL classes than in traditional F2F classes.

As such, online learning can provide fully inclusive classroom settings within the spirit of the least restrictive environment language found in the Individuals with Disabilities Education Act (IDEA). However, as the bandwidth of computer connections continues to increase, OLL will inevitably include fuller media communications featuring voice and video with sound in real-time, such as a streaming video and perhaps a "map with audio descriptions of historic locations which are activated by mouse rollover" (National Center for Accessible Media, Rich Media Accessibility, Frequently Asked Questions, 2001, ¶ 1). As this change occurs, OLL's "silent web era" will parallel the change from silent movies to talkies that occurred in the early twentieth century. Now in a new century, deaf and hard of hearing students will brace themselves for another "advance" in presentation technologies. The hope is that

this time technology also will aid these students with web-captioning, embedded media, and other solutions, rather than shut them out.

Buttressing this hope will be Section 508 of Rehabilitation Act that specifies that "Federal agencies' electronic and information technology is accessible to people with disabilities" (Federal IT Accessibility Initiative, ¶ 5). Additionally, other government entities may follow New York State in adopting the "W3C Web Content Accessibility Guidelines as a means to provide optimal access to State agency web sites and the content therein" (Natoli, 1999, ¶ 4). As stated in those guidelines, websites should "provide content that, when presented to the user, conveys essentially the same function or purpose as auditory...content" (Web Content Accessibility Guidelines 1.0, 1999, chap. 6, ¶ 1).

For the time being, though, deaf and hard of hearing students will benefit from the text-based aspects of OLL, at least as represented by instructional delivery platforms like Blackboard. Online learning will not only be anywhere, anytime learning, but also anybody. As one OLL deaf student put it,

> As a deaf adult, distance learning courses have opened additional opportunities and avenues that have long been available to my hearing peers....Besides allowing me to focus on learning as opposed to, say, wondering how much of the essence of a teacher's message the interpreter or note-taker has captured, distance learning provides a forum where deaf adults like me can share technical and non-technical expertise unhindered by language, negative attitudes, geography or distance. All told, distance learning gives me a fighting chance to stay current, competent and competitive in a fast-changing technological environment. (Lorenzo, 2000a, ¶ 16)

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Research Along the River: Using the Internet to Facilitate Collaborative Authentic Learning

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Abstract: There are two main goals of the J.A.M.E.S. Project (*www.usd.edu/ttdjames*). The first is that participating high school students apply scientific methodology and modern technology to gather and share information in a cooperative research effort. The second main goal is that participating university students facilitate the cooperative research process and sharing of data and information through the application of teaching methodologies that incorporate science, technology and distance learning. The J.A.M.E.S. Project's Web site provides the communication hub for the collaborative work between high school and university students and faculty. The site was designed and has evolved with input from all of the project's participants. The Web site posts water quality data collected by high schools along the 250-mile James River and provides bulletin boards for discussions. Participants also communicate directly via e-mail. Pictures taken at the sites during each of the data collection visits are posted to document participation.

Introduction

The Internet can provide teachers and students the opportunity to participate in project-based learning (Grabe & Grabe, 2001). Many of the elements of authentic activities and collaborative learning can be combined as students participate in a project designed to build a learning community via the web. When authentic and challenging tasks are selected and the Internet is used to provide communication among all participants the schism between real-world experience and school learning can be bridged.

It is argued that students cannot learn from teachers or technologies; rather, students learn from thinking. Thus the role of teachers and technologies in learning is indirect (Jonassen, Peck and Wilson, 1999). Teachers can stimulate and support learners and teachers can use technologies to facilitate learning. Learners must be actively engaged in constructing meaning as they face and solve real-life problems, report and share their findings, and reflect on what they have experienced.

The Project

The J.A.M.E.S. (Joining Across Miles Environmental Systems) Project is designed to allow high school students and their science teachers and university students and their professors to work collaboratively in a project-based learning environment. For the past two years high school students have had the opportunity to do authentic research, while the university science methods students have gained real life teaching experience working collaboratively with the high school students. Collaboration and communication support has been provided via the Web by additional university professors.

During the first year of the J.A.M.E.S. Project, teachers and students from two South Dakota high schools worked with professors and education students from the University of South Dakota to conduct research along the James River. The two schools are on the northern and southern borders of the state and are in close proximity to the James River. During the second year of the project, students at six additional schools along the river joined in collecting, analyzing and sharing their data.

The J.A.M.E.S. Project's Web site (*www.usd.edu/ttdjames*) provides the communication hub for the collaborative work between the schools and the university and among the high schools themselves. The design of the site has evolved with input from all of the project's participants. The Web site posts the data collected along the James River and provides bulletin boards for discussions. Participants also communicate directly via e-mail. Pictures are also taken at the sites during each of the data collection visits are posted to document participation in the research activities.

Project Goals and Objectives

There are two main goals of the J.A.M.E.S. Project. The first is that participating high school students apply scientific methodology and modern technology to gather and share information in a cooperative research effort. Specific objectives call for students to: (1) use the scientific process to investigate a problem, (2) collect, record and communicate scientific data, (3) demonstrate skill in communicating via e-mail, bulletin board and/or web page, (4) demonstrate proficiency in performing scientific measurement and using scientific equipment, and (5) analyze scientific data and create a report.

The second main goal is for participating university students to facilitate the cooperative research process and the sharing of data and information through the application of teaching methodologies that incorporate science, technology and distance. The university students: (1) demonstrate the application of science/technology/society by participating in the development of the JAMES Project web site, communicating via e-mail, bulletin board, and/or web page, and facilitating the cooperative analysis of collected data, (2) identify the pros and cons of using technology for distance projects, (3) demonstrate collaborative skills throughout the development of the project as they work with each other, the high school teachers, and the web site support personnel, (4) demonstrate questioning skills by analyzing the collected scientific data and posing questions to the students regarding the reported data and

integrating science, (5) apply the inquiry approach and project based teaching methodologies in facilitating the JAMES Project, (6) develop goals, objectives, unit plan, lesson plans, parent letter/permission slip, clipboard cruise, classroom/field trip management policies, lab report rubric, accommodations for special needs students, and a budget directly related to the J.A.M.E.S. Project, (7) determine national and state science standards met with this project, (8) evaluate final high school lab reports using the lab report rubric, (9) assist in developing the final assessmentof the high school students, and (10) develop a J.A.M.E.S. Project portfolio which contains the following elements: home web page, goals, objectives, unit plan, lesson plans, parent letter/permission slip, clipboard cruise, classroom/field trip management policies, lab report rubric, accommodations for special needs students, a budget, related national and state standards, communications with students and high school teachers, reflection on project, and other material the students may feel pertinent to be in the portfolio, such as data collected and field trip pictures.

Project Procedures

Students at each of the participating high schools observe, collect, and record the following data: (1) air and water temperatures, (2) dissolved oxygen, (3) nitrates, (4) phosphates, (5) turbidity, (6) fecal coliform, (7), biochemical oxygen demand (8) total dissolved solids, (9), hardness (10) pH level, and (11) fish survey information. Data was collected on the same days at all sites. Students also monitor and record the seasonal changes along the river. The kinds of data collected includes changes in leaf color, first frost , first ice over, first snow, and the migration of Monarch butterflies, and waterfow. Following the monitoring process, students compare and discuss the differences along the more than 250-mile stretch of the James River between Aberdeen, SD and Yankton, SD.

The data from each visit is then forwarded to the University of South Dakota web team, who post the data on the J.A.M.E.S. Project Web site. The USD science methods students then use the web to follow-up with a "Question of the Week" and/or activity based on the data received from the high school students. The high school students' responses the University student's questions are then posted on a web bulletin board so that the high school students can interact with each other. As a final activity of the semester, the participating high school students produce a final lab report and respond to a final question based on the entire investigation.

Outcomes to Date

The J.A.M.E.S. Project has had a positive impact on all of the participants. The project is an active science process in which students not only take measurements, but also discuss the variation of results. Students integrate science content and activities into the process, while constructing and debating scientific knowledge as they generate questions and thoughts in a critical manner. These responses are then shared with students at the partnering schools, thereby allowing students to emulate how scientists interact and exchange information.

The collaboration of students spread along 250-miles of the James River is made possible because of the Internet. Technology plays an important complementary role because it provides a mechanism for expedient sharing of data through e-mail communication, publishing data on a web site, and follow-up discussion sessions using electronic bulletin boards.

The collaboration achieved demonstrates the ability of university and K-12 schools to work together to conduct an important and relevant research study. Overall the high school students indicate they enjoy participating in the project and were able to see its value. Communicating with students from another high school and with college students is another positive aspect of the project. In addition to the positive results for students, teachers who participate in the project developed a community of learners that promoted professional development.

Project Expansion

The J.A.M.E.S. Project has been funded for a third year of activities. An expansion of the use of technology is planned through the use of PDA's portable and wireless capabilities and through the use of global positioning devices. Future plans call for a replication along a different river or at lakes. This is a project that would not have been as possible 10 years ago. Effective collaboration, communication and real world learning are possible through the use of the Internet and other technologies, while maintaining the focus on the science content.

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The School of Education at the University of South Dakota continues to provide support for the J.A.M.E.S. Project. Faculty from both the Curriculum and Instruction and the Technology for Training and Development Divisions have worked cooperatively to insure the success of the J.A.M.E.S. Project since it began.

The South Dakota schools participating in the J.A.M.E.S. Project are: (1) Aberdeen Roncalli Jr./Sr. High School,
(2) Northwestern High School, (3) Redfield High School, (4) Huron High School, (5) Mitchell High School,
(6) Hanson High School, (7) Menno High School, (8)Yankton High School and (9) Yankton Middle School. Teachers and Students at the participating schools are identified on the J.A.M.E.S. Project Web site.

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How to validate an online learning programmes - a model from HE experience in the UK

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In my paper 'The Validation of Online Learning' delivered at the SITE conference in May 2001, I argued that the validation of online learning programmes in higher education demanded a new and dedicated approach.

Since that time I have been working towards a model system to determine the validity of online learning programmes and by October this year this model will have been tested in the context of two new programmes validated in the UK by the University of Plymouth.

These two programmes are a BSc in Engineering, and a foundation BA in Business for Voluntary Organisations. In both cases there are sound reasons why an online and distance learning approach is suitable for the particular requirements of the student cohort.

This validation system entails a richer approach to the validation process than is commonly encountered in the validation of traditionally delivered degrees. Emphasis is given to the development of a multi-skilled team capable of contributing both formatively and summatively to decisions concerning the new programme.

This paper will detail the model developed to address these issues, and will propose a generic approach suitable for application in a variety of online higher education contexts.

The paper will also discuss whether it is possible, or reasonable, to deliver degree level education entirely online, or if there are particular characteristics of the online context that make it unsuitable for more advanced study.

Distance Learning from Three Perspectives: Key Issues & Concerns

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The questions and concerns covered in this presentation will be beneficial to universities and colleges trying to determine what role distance education will play in the provision of courses leading to a degree. Although other topics may be introduced as part of the interaction and discussion with the audience, the initial presentation will focus on six key questions:

- What are the major differences between online courses and the traditional classroom?
- Can all courses be adapted to distance learning?
- Why develop and offer online courses?
- Are there advantages to using some of the techniques of online learning without fully implementing an online course?
- Does distance learning lose the social aspect of teaching?
- Is there a profile of a student who should *not* undertake online course work?

Major difference between online and traditional courses.

In planning for online courses, everyone needs to be aware of the differences between online courses and traditional courses. In most cases, instructors will be translating an existing course into an online format. The time requirement for the translation from traditional to online is a major factor. The redesign of the course will require considerable reflection, time and energy. Issues related to communication, maintaining the integrity of content and experiences require careful thought. If field experiences are a requirement for the course, then various logistical details will need attention. The provision of clear, concise directions and assignment requirements needs extra attention in the design phase.

Technical support issues become critical to both the instructor and the students. Providing adequate orientation to the students is a must. Having a plan and the necessary technology personnel to address questions and correct problems with software and hardware must be in place. Email, threaded discussions, and file sharing are the lifeblood of an online course. If any or all of these components of ongoing communication fail, the course is "dead in the water". Frustrations are high enough with the crashing of computers and software, but major glitches in the servers or the primary software add insult to injury for both the instructor and the students.

Basically, one should plan on increasing the time required for the initial offering of an online course at all points in the process from planning/design to the actual teaching. Patience and ongoing communication among all parties involved are necessary to insure the level of success desired.

Can all courses be adapted to distance learning?

Undoubtedly, some courses can be easily adapted to online learning whereas others may require considerable creativity on the part of the developers. In reality, the issue may not be can a course be adapted, but rather should it be adapted. Technically speaking, virtually any course *could* be adapted to online, but the validity of making that adaptation should also be considered. Before adopting an online format, key issues should be considered about the advantages and disadvantages of online learning for a specific course, as well as for the specific group of learners who will be taking the course. For example, should an online high school course be developed for a class composed of mostly inner-city students? Most of the children in that case may not have easy access to the Internet or even to computers. Obviously, before implementing a course an assessment of the availability of hardware and software must be made.

Recent research has shown that two of the advantages of online learning include an increase in both the student to student and student to professor interactions. The argument could be made, however, that these types of

online interactions are far different from the development of interpersonal skills that may be required in certain courses. For example, could a course on Oral Presentation be adapted to an online format? Furthermore, history reveals that men such as Johannes Kepler or Issac Newton who were geniuses on paper were pathetic examples as teachers. The development of good interpersonal skills are key for preservice teachers. The development of interpersonal skills would be difficult to teach in a course that is taught entirely online.

Why develop and offer online courses?

Before a decision is made relative to offering online courses, the "why" of the decision needs to be examined. What are the reasons for this decision? Who is the target audience? Will this decision help to reach individuals who are not being reached by existing methods? These basic questions are connected to the mission of the institution and the future directions of the institution. The marketing of online courses is vital and totally related to the decision of offering online courses. What ways will be used in communicating to the various audiences the availability and value of the institution's online courses. Care needs to be taken in communicating the design and place of online courses within the degree programs of the institution. The benefits to individuals taking the online courses need to be well defined by the institution. The cost factors related to personnel, hardware and software, technology support, and ease of use for the students need to be evaluated carefully.

Another issue in the decision-making phase is the need to get all of the stakeholders in the same room at the same time. The technology support staff and the teaching staff need to be communicating with administrators about the needs and demands that an online course will present. These key players in the delivery of the online courses must be an integral part of the planning from the outset. Their input will help to answer many of the key questions and will help to determine the initial cost of the programming.

Are there advantages to using some of the techniques of online learning without fully implementing an online course?

Arguments have been made that the traditional classroom is far too focused on the teacher. The teacher develops the lesson plan, carries out its presentation and then assigns follow-up activities. Virtually every activity focuses on the teacher. Such minimal involvement from the learners results in minimal learning. Recent research has shown that greater learning can be promoted by dispensing with the "sage on stage" model and by promoting a "guide on the side" model. Yet, as mentioned earlier, not every aspect of every course can be validly translated to an online format. Some courses may require that the "guide on the side" be in closer proximity to the learner than would be possible in an online environment.

Therefore, the clear solution may to incorporate aspects of the online world within the so-called traditional classroom. In the spring of 2001, the professors on the panel each made the decision to restructure one course to an online format while retaining the traditional format for their other courses. The presenters will share their reasoning in determining whether a course should be offered in an online format.

Does distance learning lose the social aspect of teaching, resulting in a disconnectedness between the faculty and their students?

An argument could be made that distance learning loses the socialization aspects associated with education. Furthermore, online course work creates a sense of disconnectedness from a community, promoting instead all the negative aspects of individualism. On the other hand, the format and structure of the traditional educational classroom serves not only as a laboratory for learning, but also maintains and perpetuates the culture. For example, in *When tolerance is no Virtue*, Gaede points out that education must "cultivate people of virtue: people who treat each other fairly, who act wisely, who have the courage to do what is right and who practice restraint and self-control". Does an online course necessarily lose the ability to maintain the culture?

Presumably the intricacies of interaction associated with the traditional classroom structure helps to maintain and perpetuate the culture. If we grant that the increase in distance learning will stifle the community and the culture, then colleges and universities should indeed avoid extensively promoting online degrees. Creativity and forethought, however, can do much to avoid the loss of socialization. It remains incumbent on the developers of

online learning to incorporate activities into their online courses that will encourage socialization rather than individualism and isolation.

Threaded discussions and frequent e-mails certainly encourage the written aspect of socialization. Students who in the traditional classroom remained timid and withdrawn may actually involve themselves more in the social nature of the online classroom. In teacher education and other professional fields, required practicums can enhance socialization far more than is experienced in a purely on campus course. Videoconferences, one-on-one sessions with the professor, occasional group meetings are a few more techniques that could be incorporated into online courses. Therefore, the issue of whether or not an online course promotes disconnectedness rests solely on the careful planning of the developers of each course.

Is there a profile of a student who should not undertake online course work?

Yes. Students should not enroll in an online course if the format of the course will create for the student a likelihood of failure. The panelists will portray different characteristics of students that might suggest that they would not be successful in an online environment. Clearly students who do not have access to the required technology should not enroll. Equally important may be the fact that students who are overly computer-phobic should not enroll. Efforts can be made to assist these students in overcoming their fears. Most professors, however, are not willing to add the additional burden of trying to teach a computer course at the same time as teaching the regular course work.

Not as obvious at first but even more disastrous is the fact that only students who are sufficiently self-motivated should take an online course. Showing up for seat time in traditional class is far easier for some students than it is to take time to individually sit at a computer and concentrate on the work at hand. Deadlines may come and go without the shouting voice of a professor or at least that disapproving glance that provides some students their only motivation to complete their work. An occasional e-mail with a subject line "Are you there?" simply doesn't have enough impact to motivate a student who lacks inward drive. Advisors should take care to assess the characteristics of their advisees before they suggest enrolling into the online world.

Tools and Techniques for Searching the Visible and Invisible Web

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Abstract: This paper introduces electronic information literacy competencies (IL) as a prerequisite to effective Web searching. Habits of Web searchers that influence search outcomes are examined and related to finding information resources found on the visible (VW) and invisible Web (IW). Pre-search and post-search tools and techniques for improving IL are discussed. Pre-search tools include software applications, pathfinders, Web Quests and vocabulary aids. Post-search tools include computing recall and precision, software tools, and filtered publication lists.

The Association for Educational Communication and Technology (AECT) and the American Association of School Librarians (AASL) have endorsed Information Literacy (IL) standards for K-12 education. (AASL, 1998) The Association of College and Research Libraries (ACRL) has endorsed IL standards for higher education. (ACRL, 1999) In order to be information literate, a person must know how to identify relevant information sources, develop effective strategies and queries and be able to utilize the information for effective decision making. Several factors contribute to a low literacy level in people. One of the major factors is that people are lazy. They are unwilling to do the background research needed to analyze an information need. People want information immediately, in full-text, and free. Another human factor is a lack of knowledge on how to search effectively, being able to identify a variety of information sources, knowing when a diminishing point of return is reached, and how to organize the results. A third major factor is that many Web-based publications are poorly indexed or not even indexed by popular search engines, thereby inaccessible to the illiterate. Humankind will generate more original information over the next three years than was created in the previous 300,000 years combined; thereby making online searching even more difficult. (Lyman, 2000)

Traditional search engines, such as Yahoo or Alta Vista, are generally sufficient for meeting children's information needs. The indexable range of general search engines is known as the visible Web (VW). For dult learners, the Web can also reach numerous specialized databases that are not indexed by traditional search engines. Databases such as ERIC, INSPEC, Medline and others constitute what is termed the invisible Web(IW). (Sherman, 1999) VW sources are diverse and have a higher mix of multimedia. IW sources are generally more scholarly, authoritative, and comprehensive and the IW is over 500 times larger than the visible Web. (IW, 2000) Despite its size, most people are not aware of the invisible Web, much less know how to access it. To resolve some of the problems associated with effective online searching, a number of front-end and back-end tools are available.

Front-end tools typically consist of software designed to increase recall of a large variety of multimedia information or to develop algorithmic search techniques. Some examples include techniques for enhancing Web sites, XML to facilitate document identification and indexing, browser add-ons that permit retrieval of disparate document formats and customizable search engines. Examples include: Google now indexes pdf documents; Lycos provides the invisible Web Catalog and custom human-based searching; Intelliseek supports Invisibleweb.com and markets BullsEye, a desktop based meta search engine that accesses many IW sites; Northern Lights provides access to numerous electronic journals; xrefer provides an online reference engine; and Karnak has a current awareness feature. Not all such services are free. Larger businesses and libraries subscribe to vendors that host proprietary IW databases. The largest of these is Dialog. Dialog provides access to over 600 databases representing numerous disciplines and related fields. Dialog is particularly strong in business, the physical sciences, engineering, and the health sciences. One benefit of using Dialog is that all databases are accessible using the same search language. Dialog also has a cross-database search feature that allows simultaneous searching of some or all databases. There are numerous other features that make Dialog well worth considering. BookWhere 2000 (Balboa Software) offers similar features for searching free IW databases.

Other front-end tools help users identify appropriate vocabulary to formulate more robust search strategies. One example consists of both offline and online thesauri that either accompany a database, or simple define the vocabulary in a general field. For example, the "The Plumb Design Visual Thesaurus is an exploration of sense relationships within the English language. By clicking on words, you follow a thread of meaning, creating a spatial map of linguistic associations." (Plumb, 1998) Searchers can also work through various online tutorials and search help sites. Some front-end tools add additional levels of complexity or expense to what may already be a difficult process for novice users. Simpler tools to use are recommended lists of types of sources, or those that act as Web guides. Some examples follow. Web Quests consist of Web pages that guide users to relevant sources in a number of areas, or act as a search tutorial. Scavenger or treasure hunts are teacher-facilitated search aides that guide students to relevant sites and help them to navigate the complex pages of selected sites. (WebQuests, 2000) Electronic pathfinders are topical lists of resources geared more toward accessing offline and VW or IW resources. (Pathfinders, 1996) Pathfinders list representative types of information sources and sample records often overlooked by a user. Not only do pathfinders provide URLs for electronic text publications, but also for a variety of multimedia resources, human resources, usenets, and more. Pathfinders may list associations, conference proceedings, journals, free publications and secondary information sources. Pathfinders are available for a large number of subjects from the web sites of university libraries. The Library of Congress has been providing pathfinders termed "tracer bullets" for several years. (LC, 1997) Tracer bullets are available free and include both online and offline information sources for primarily scientific and technical topics. The major difficulty with pathfinders is that they may be out of date or that users do not have access to sites or specific publications.

On the back-end, most tools consist of source lists of Web publications recommended for specific applications or fields. The largest human edited directory of the Web is the Open Directory Project. As of July 11, 2001 it consisted of 2,710,687 sites, 38,488 editors and 385,480 categories (DMOZ, 2001) Examples of other large lists of filtered Web resources are Infomine, Librarians' Index to the Internet, the Internet Public Library and the Texas State electronic Library. (Texas, 2000) Once a search is performed, a number of techniques are available for judging the effectiveness of the search. For example, searchers should be aware of how to compute recall and precision values. (Buckland, 1996) Knowing how to read the values provides a measure of retrieval effectiveness. Developing a bibliography matrix helps to analyze information needs that need further research. (Matrix, 1999) The matrix consists of a contingency table for variables associated with the information need. Placing relevant document numbers into the intersection of the variables helps determine the exhaustivity of a search as well as ideas for new search strategies heretofore not considered. Software applications are also available for managing bibliographic and textual databases. One popular example is Library Master from Balboa Software. (Balboa, 2001)

Both front-end and back-end tools help children and adults meet their information needs. Schools, businesses, and other organizations are urged to develop formal IL programs that introduce appropriate information tools and techniques to children and adults. (Spitzer, 1998)

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Incorporating cognitive styles into Adaptive Educational Systems: a prototype implementation

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Although cognitive style has an influence on how students interact in their learning environments, there is little research to examine how to design an adaptive hypermedia system based on student's cognitive style. This paper deals with the design and the development of an Adaptive Educational Systems (AES) that includes accommodations for cognitive styles in order to improve student interactions and learning outcomes. The goal of this approach is to examine some of the critical variables, which may be important in the design of an AES based on student's cognitive style. The main idea behind this project is to improve the knowledge gain by the student using issues of both student cognitive style and teaching strategy. We are focusing on adapting the teaching strategy to the learner's cognitive styles. Furthermore, we aim to provide evidence to support the view that the adaptivity based on student's cognitive style could be beneficial for the observed learning outcomes. This study additionally focuses on the relationship between the adaptivity based on cognitive style and student's motivation. Our research goal is to identify the degree of interaction between motivation and cognitive styles factors.

See Yourself IMprove (SYIM)
Implementing an educational environment for individual distance education services and student modeling

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Abstract

The current paper describes the implementation of domain independent a educational environment for the provision of personalized distance education services and for the construction of student models via distance, called See Yourself Improve (SYIM) to be applied to asynchronous distance education sessions.

The core idea of SYIM is to help the tutors to monitor the individual learning needs and the misconceptions of the distance students and to keep a track of the feedback provided to each student.

Additionally SYIM provides to the students the benefit of the intense supervision related to their individual learning needs and the effective support and guidance on how to overcome a misconception or remedy a performance gap in order to improve both their performance and their context comprehension

Demo URL: http://zeus.it.uom.gr/syim/ 3wview/index.htm
(Viewed by Internet Explorer)

Introduction

Student modeling is defined as the task of describing the knowle dge and beliefs of the student as a basis for the decision on appropriate actions for feedback.

According Barr and Greer: "Student Model represents student understanding of the material to be taught with the purpose to make hypotheses about students' misconceptions and suboptimal performance strategies" (Barr et al., 1982).

In general terms, student modeling involves the construction of a qualitative representation that accounts for student behavior in terms of existing background knowledge about a domain and about students learning the domain. Such a representation, called a student model, can assist an intelligent tutoring system, an intelligent learning environment, or an intelligent collaborative learner in adapting to specific aspects of student behavior (McCalla, 1992).

A number of Student Models have been reported in the literature. Some of the implemented models were domain independent (Greer and McCalla 1994 ; Kass, 1989, p. 386-410; Bull and Smith, 1997, p. 339-341, Tsinakos and Margaritis 1999, p. 1071-1076) while some others had domain dependency (Katz et al., 1993; Conati and VanLehn, 1996; VanLehn and Martin1997, p. 179-221 ; Conati *et al.*, 1997, p. 231-242).

Student Models are used to elicit information from the students regarding their misconceptions or their weaknesses during the learning session. Furthermore, Student Models may be used to provide help and feedback to the students according to their learning preferences. The general achievements gained by the use of Student Models in education were the inspection and analysis of students' mental behavior, of their reasoning and of the knowledge that was believed to underlie such behavior.

Student Models can positively affect areas of distance education in a similar way as in conventional education, by promoting the achievement of better teaching and learning activities.

The discontinuity of the asynchronous distance education sessions, in addition to the lack of face-to-face contact, causes a pedagogical disadvantage affecting both the tutor and the students. Tutors are less capable of monitoring the individual learning needs of each of the distance students, and in forming a valid image of their performance progress. Thus feedback is more difficult to provide and to be used by the students, especially when the tutor is not present. Lack of intense supervision and support that is related to the students' individual learning needs might also be recognized.

The See Yourself Improve (SYIM) environment aims to remedy all these problems as it makes the feedback process more systematic and permits more communication between tutor and student. Additionally using SYIM a student model can be generated by recording the tutor's suggestions and feedback regarding the students' progress in addition to the comments made by the students regarding their personal problems or the misconceptions what have occurred.

SYIM can be used in any course/session available via distance in an asynchronous based scenario with no face-to-face requirements. The only limitation is that, in such sessions is assumed that a human tutor will supervise the students and that the students' evaluation process will include a number of written assignments. The course can even be a part of an under or postgraduate program and it is assumed that the number of students participating in the course will not be more that twenty to twenty-five.

Implementation of the SYIM

The SYIM model is a domain independent domain educational environment for the provision of personalized distance education services and for the construction of

student models, to be used in asynchronous distance education sessions. The model was partly based on the See Yourself - Write model introduced by Susan Bull (Bull, 1997)

The scope of implementing the SYIM was to remedy as many distance education problems as possible, such as discontinuity of the educational session, lack of intense supervision, hazy monitoring of distance students' progress or faint recording of their individual learning needs. In more detail, the core idea of implementing the SYIM model was: a. to help the tutors to monitor the individual learning needs and the misconceptions of the distance students, b. to keep track of the feedback provided to each student, c. to provide the students with the benefit of the intense supervision related to their individual learning needs and the effective support and guidance on how to overcome a misconception or remedy a performance gap in order to improve both their performance and their context comprehension.

To achieve these goals SYIM was implemented using three different interfaces/views. One was called "Tutor View," for the tutor's use, the other was called "Student View," used by the student and the third was called the "Administration View" to be used by the system administration. A detailed description of each view will follow.

As a first step the user is prompted to enter the assigned Username and the Password in order to login in the SYIM environment. According to the provided login, SYIM recognizes if the user is a tutor or a student and therefore logs the user into the appropriate interface/view.

The Tutor View

In case that the user is an instructor, "Tutor View" is uploaded and the following list of options appears in SYIM toolbar. In more detail Tutor's options are:

1. *Home Page*: To return to the SYIM Home Page,
2. *List all sessions*: To check all the sessions/courses in which the Tutor is participating.
3. *Setup a new session:* To create a new session /course to be taught,
4. *Edit session:* To remove a session/course that already exists.
5. *Logout*: To logout from SYIM.
6. An online help file is also available.

The options 3 and 2 are further discussed.

Setting up a new session: During the setup phase tutor has to define session's parameters. Each session has a title, a number of assignments and a number of evaluation criteria. The tutor is able to define a new evaluation criterion or to select among the list of the evaluation criteria that have already been defined by other tutors. The idea of displaying a list of the available evaluation criteria is to avoid duplications in the criteria formulation process and to help the tutor see what kind of evaluation criteria are used by other tutors. As a next step the tutor has to declare the students that are going to participate in the session. It is worth mentioning that at the time that students are selected to participate, SYIM sends an e-mail notification to each of these students. In more detail each of the participants receive an e-mail in which their login and password to the SYIM system is included

Beyond the parameters defined by the tutor, a number of session parameters are automatically generated by the SYIM. These are

Conference Participation Field: In this field the tutor provides the quantitative and the qualitative performance regarding student's participation in each conference session.

Overall Assessment Field : In this field, quantitative performance of the student on each criterion is automatically summed up.

Misconceptions Field: In this field the student reports pote ntial misconceptions that might have occurred (Main concept), in addition to a short description of what the misconception concerned and why it occurred (Student's explanation). Furthermore, the tutor can reply to each student's request for further clarification, in the form of a conference, like a threaded discussion. By the end of the course the teacher is able to trace all the misconceptions reported by each student or all the misconceptions reported by all the students participating in the course, and use such information for further implementation.

How To Improve Field: In this field the tutor reports a potential performance problem, asking the student to give explanations or reasons why this problem occurred (self-reflection and explanation). Based on student's response, the tutor provides guidance on how such a problem can be remedied.

Total Field: In this field the student's total quantitative performance is reported both on each assignment and on the overall course. In addition the tutor can provide qualitative comments.

List all participating sessions: This option creates a list of all the sessions that are assigned to the particular tutor that has logged in, acting like an online tutor's agenda. To select a session, the tutor has just to click on the session's name. Once a session is selected, information regarding the selected session is displayed (Session-specific options) and the tutor's toolbar is further expanded to include some new options which are session sensitive. These options are:

1. Sessions-specific options: Via this option the tutor can check, beyond the general information of a particular session, the improvement of each trainee participating in the session. This can be done by clicking on a trainee's name and therefore the main perfor mance table of the SYIM environment for the selected trainee appears providing the following information Session Title, Trainee's name and e-mail , Titles of assignments, The evaluation criteria for the assignments, Conference Participation performance, Misconceptions that the trainee might have regarding the taught context and the instructor's comments on how the trainee's performance should be improved (How to improve)

The main table of the SYIM displays not only quantitative information regarding the trainee's progress (i.e. various marks assigned by the instructor) but also qualitative information (i.e., the instructor's comments on the assigned mark).

Every such table is unique and is assigned to each student participating in the session. According to the number of assignments set by the instructor during the session's set up phase, a corresponding number of misconception indices is created. This feature enables both the tutor and the student to monitor and post misconceptions in chronological segments according to the material context encompassed by each assignment. The instructor can check on the student's misconception list by clicking on the relevant hyperlink word of the misconceptions line. It is worth mentioning that only the trainee can create/post an initial misconception thread. Furthermore the instructor can read the student's misconception and provide a reply in a form of a www based message board conference.

A trainee can create as many misconceptions threads or replies as they think necessary. Likewise there is no limit to the number of replies posted by the instructor for a misconception to be overcome.

The option of How To Improve (HTI) has an analogous structure and implementation to that of the misconception option (www based message board conference) including a list of the instructor's suggestions on how a particular trainee's

performance can be can improved. It is important to mention that only the instructor may create initial HTI threads

2. *View all misconceptions:* This option provides the ability to the instructor to check on the misconception list of each of the session's participants at a glance. Each trainee's misconception appears in a list having the trainee's name on the top and the misconception titles, in red, as elements of that list. In this way, the instructor is capable of tracking all students' misconceptions in order to formulate an opinion regarding what was the most common misconception among the students, what was the most difficult part of the context for them, and what particular context comprehension difficulties each student was confronted with.

3 *View all HTI discussions:* Similarly to the "View all misconceptions" option, the current option enables the instructor to read at a glance the entire How To Improve discussion list of each of the session's participants. With this feature, the instructor is capable of tracking all students' performance problems and to identify what was the most common performance problem among them, what was the most difficult skill for students to achieve, and which part of context requires more guidance and support for the students. Similarly to the misconception list, the instructor can retrieve more information on the guidance provided to a trainee simply by clicking on the title of an HTI thread. In this case the correspondent HTI context and the relevant discussion appears in an expanded menu.

4. *Criterion/Assignment Graphic analysis*: Criterion/Assignment Graphic analysis in combination with Session Total Graphic analysis is two options for statistical use. The current option displays an analysis of trainees overall performance per evaluation criterion for each assignment (Figure 11). These diagrams enable the instructor to easily check trainees' performance on each criterion in order better understanding of students' comprehension ability to be achieved.

5. *Session Total Graphic analysis*: This option provides the instructor with a graphical representation of the final performance of trainees on a particular session. This diagram is a kind of easy and handy statistical information to be used as part of the session's summative evaluation.

The Student View:

In case that the user is a trainee, the "Student View" is uploaded and the following list of options appears in SYIM toolbar:

1. *Home Page*: Return to the SYIM Home Page,
2. *List all participating sessions:* Check all the sessions-courses that the student is participating in,
3. *Logout*: Logout from SYIM,
4. *An online help* file is also available.

Using this simple interface, student can access all the features of the SYIM model. Option 2 is discussed in detail:

List all participating sessions: This option creates a list of all the sessions that are assigned to the particular student that has logged in, acting like an online student's agenda. To select a session the trainee has just to click on the session's name. Having done that, information regarding the selected session is displayed.

By clicking on the hyperlink option "View your improvement in this session", the trainee can access the main performance table of the SYIM and read the instructor's comments, assigned marks or context related clarifications.

As was already stated in "Tutor View" section, the main performance table of the SYIM displays not only quantitative information regarding the trainee's progress (i.e.

various marks assigned by the instructor) but also qualitative information (i.e. instructor's comments on the assigned mark). Furthermore, by clicking on the appropriate hyperlink word of the misconceptions line, a list of trainee's misconceptions appears . The trainee can post a new misconception or check the instructor's reply to a pre posted misconception. The new element in this section is the student's ability to create a new/initial misconception thread using the "Create new misconception" option. Note that only the trainee can create new misconception threads while the instructor can only reply to them. It is worth to mention that there is no limit to the number of the misconceptions that may be posted.

Similarly to the misconception option, the trainee, by clicking on the hyperlink word (More) of the How To Improve (HTI) line, may view a list of the instructor's suggestions on how the trainee's performance can be can improved. The trainee can check the instructor's suggestions on a performance problem and reply to the instructor's post asking for further guidance.

Administration View.

This third component of "Administration View" was developed to remedy some administrative issues that may arose during an education session. To access this third component the user has to be verified as being SYIM's administrator by passing a double password check in order to ensure security. Once the user is logged in as administrator, "Admin View" is uploaded and the following list of options appears in SYIM toolbar. In more detail Administration's options are:

1. Home Page : To return to the SYIM admin Home Page
2. Edit instructors: This option creates a list of the tutors that are registered in the SYIM and it is selected when the administrator wants to disable an instructor's account, in case that the particular instructor does not belong anymore in the teaching staff or when an instructor's login profile has to be changed, for example the instructor's name or e-mail has been changed or a new password is required.
3. Add new instructor : This option enables the administrator to add a new instructor by entering the instructor's name, surname and email address. A notification e-mail informing the instructor about how to access SYIM (login name, passwor d and URL to access) is automatically created and sent out to the predefined e-mail address and by the same time current tutor is added in the SYIM instructors list.
4. Edit trainees: This option, similarly to the Edit instructors, creates a list of the students that are registered in the SYIM and it is used in cases where The administrator wants to disable a student's account, in case that the latter does not participate in any session or a student's login profile has to be changed
5. Add new trainee: This option enables the administrator to add a new student in a similar way to the option of "Adding a new Instructor".
6. Edit Criteria: This option creates a list of the evaluation criteria that the SYIM tutors have entered. It enables the administrator to be aware "at a glance" of the criteria available in the SYIM list and remove duplications or disable the unwanted ones.
7. Logout: To logout from SYIM admin view.
8. Finally an online help file is also available.

Summary

The SYIM model is a domain independent student model to be used in asynchronous distance education sessions. It can be accessed via the Web and the scope of implementing the SYIM model was to remedy as many distance education problems

as possible. It is comprised of three different interfaces/views; the "Tutor view" which is used by the instructor the "Student view" which is used by the students and the "Administration View" which is used by the system administration..

A number of facilities are available in SYIM to enable the tutor to monitor the students' progress and their learning needs. Similar facilities are available for the students, so that they can take the benefit of intense supervision related to their individual learning needs and of effective support by the tutor on how to overcome a misconception in order to improve both their performance and their context comprehension.

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An Advanced Digital Image Repository and an XML-based application for Intellectual Property Protection and Management of Digital Objects

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Abstract: The main issue addressed in this paper is the design and implementation of an Advanced Digital Image Repository, which offers specialized services for the protection and management of the Intellectual Property Rights of digitized material. In addition, another main research area of this contribution is the implementation of an XML Schema, supported by advanced technologies, for the Internet-based management of the Digital Image Repository and the interchangeability of the digital cultural content. The work described in this contribution focuses on digitized material of the Hellenic Cultural Heritage. It has been carried out as part of the PRAXITELIS Project [1], which was presented during the Culture Track of the WWW9 Conference in Amsterdam (Tsolis G., 2000). This project is focusing on countering "electronic theft" and protecting the copyright of digital surrogates of photographs of artifacts, monuments and sites.

Introduction

The evolution of technology is challenging the status quo of Intellectual Property (IP) protection and management in many ways. Recent years have seen the exploration of many technical mechanisms intended to protect IP in digital form, along with attempts to develop commercial products and services based on those mechanisms (Computer Science and Communications Board, 1999). These mechanisms include interchangeable metadata to characterize the digital object and its IP Rights (IPR), unique global identifiers for the digital objects, watermarking techniques to mark, detect and prove the existence of the copyright of a digital image, audio and video, encrypted and secure data transfer through networks, etc. This section is focusing briefly on describing the general concepts, the results so far, and the continuation of the implementation of an information system, which incorporates all those mechanisms.
The general concept of the integrated information system for management, protection and exploitation of digitized photographs of the Hellenic Cultural Heritage is the design and implementation of a modular system that embodies the following characteristics and tools (Tsolis G., 2000):

- Content Creation / Digitization tools.
- Digital Repositories that support for:
  - Metadata for the management of data about the digital image's description and copyright.
  - Global standards for the unique identification of the digital images.
  - Watermarking for the IPR management and protection.
- On – Line Payment System.

The definition of sets of metadata, which are tightly coupled with the high quality digital surrogates of objects of the Hellenic Cultural Heritage, is based upon the DIG35 specification "Metadata for Digital Images", Version 1.1 (Completed on July 2001) (Digital Imaging Group, 2001). According to this standard, the metadata sets are divided in technical metadata, image creation metadata, content description metadata, history metadata and IPR metadata. The watermarking techniques that are embodied in this system have been evaluated exhaustively (Tsolis D., 2000) and in many cases were further improved, so as to effectively protect and manage the Intellectual Property Rights, in accordance with the technical requirements of the Hellenic Ministry of Culture and the national and international legislation.

The primary target of the current phase is the implementation of an Advanced Digital Image Repository, which, except of the above capabilities (metadata, unique identifiers and watermarking), provides for specialized services and user interfaces for the efficient and resourceful retrieval, including search by image content. In addition, this phase equally focuses on the creation of user interfaces (in

[1] The project is funded by the Hellenic Ministry of Culture (HMC) and the Greek Secretariat of Research and Technology (GSRT), project number 96SYN132, and is expected to complete by mid 2001.

HTML, JAVA and Visual Basic), with which the user input is transformed into queries to the repository and an XML Schema produces the results in XML files.

Advanced Digital Image Repository

The design and implementation of the Advanced Digital Image Repository for this information system is a very important task. A repository fully capable to serve as a platform to this system should incorporate the following basic characteristics:

- Scalable. That is, the capability of gradually improving its performance in accordance with the platform and the number of computing resources used. The information system is a distributed one. Independent repositories already exist throughout Greece and are installed in the Ephorates and other authoritative Agencies of the Hellenic Ministry of Culture. The integration of these independent installations requires a scalable and modular repository.
- Support for multimedia and advanced hypermedia applications for digital image, audio, animation and video.
- Internet oriented, providing secure and easy access to data and metadata via the Internet and corporate Intranets. The Hellenic Ministry of Culture already has a corporate Intranet (designed and implemented by the High Performance Information Systems Laboratory) and, as a result, the integration of the digital repository to this already existing framework is considered necessary.
- Support for applications and interfaces for data and metadata manipulation. These applications do not only include the built-in mechanisms of the database management system, but also user interfaces developed and customized in a way that meet the needs and requirements of this project.
- Usability and effective management. Ease of implementation, configuration and use. Open to programmers and developers for its customization.
- Global access from distributed locations, supported by technologies for protected transactions and data transfer, replication and backing-up, data encryption and decryption.
- Open to new technologies and programming languages like JAVA and XML.
- Scheduled synchronization of distributed database instances in a national network of Digital Image Repositories. The central Advanced Digital Image Repository is being implemented in the premises of the Hellenic Ministry of Culture. Other databases will be distributed locally all over Greece, especially to locations of major cultural importance.

Except of these basic characteristics, metadata for digital images, unique identifiers and watermarking methods are embedded into the Advanced Digital Image Repository. The Advanced Digital Image Repository is implemented using the IBM DB2 Universal Database (Version 7.1, Fix Pack 3) with the AIV (Audio, Image and Video) and XML Extenders (IBM, 2001).

Selection of Metadata for Digital Images and IPR Management

The specific tables and fields, which are used for the repository of the digital images, were selected in the basis of the next requirements:

- The user requirements of the Hellenic Ministry of Culture.
- The international standards for describing, characterizing and identifying digital objects.
- The international standards for managing and protecting the Intellectual Property Rights.

The need of adopting the international standards is essential, especially for applications aiming cultural content exchange and on-line payment. Following these guidelines, the result is an open information system ready to be integrated into an expanding global, multi-language and multi-national network were the digital objects and the metadata coupled with them are uniquely identifiable and interchangeable.

The DIG 35 Specification "Metadata for Digital Images", Version 1.1 (Digital Imaging Group, 2001) has a very important role in this selection of fields and tables, as far as the metadata for the digital images are concerned. This metadata standard is already being widely used from simple end-user devices to worldwide networks. The database structure has a special focus on metadata for the Intellectual Property Rights management. A simplified description of the database structure already implemented follows.

Basic Metadata Table of the Digital Image

This table includes the next fields, which point to other relevant tables:

- Digital Image ID number (unique identifier).
- Basic Image Parameter.
- Image Creation Metadata.
- Image Description Metadata.
- History Metadata.
- IPR Metadata.

Basic Image Parameter

A simplified description of the structure of this table is presented (Fig. 1):

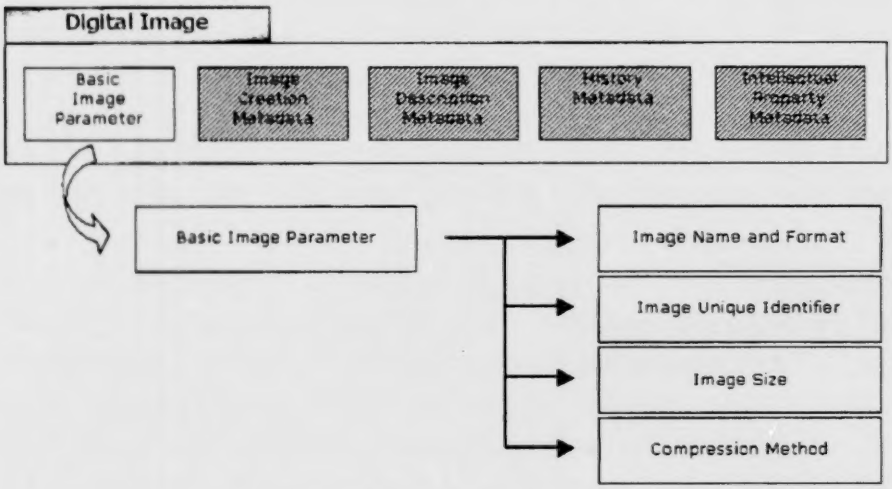

Figure 1: Basic Image Parameter Table

Image Creation Metadata

The image creation metadata include fields ranging from the general information of the creation of the image to specific information about the camera or the scanner used during the creation of the image. More specifically:

- Fields for the general information of creation.
- The Camera Capture field incorporating the fields:
  - Camera Information.
  - Software Information.
  - Flash Information.
  - Camera Settings.
- The Scanner Capture field incorporating the fields:
  - Scanner Information.
  - Software Information.
  - Scanner Settings.
- The Captured Item field, which contains information about the object that is captured by the device (like a film or a reflection print or even a computer-generated item).

Image Description Metadata

This table includes the next fields, which point to other relevant tables:

- Group Caption.
- Capture Date and Time.
- Location.
- Person Description.
- Thing Description.
- Organization Description.
- Event.

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- Sound.
- Dictionary Definitions.
- Comments.

History Metadata

The table of History Metadata contains information about the history of the image processing. It includes the next fields:

- The processing summary of the image, describing processes such as rotation, compression, cropping and histogram modification.
- The history of the image metadata.

IPR Metadata

This table could be characterized as the lifeblood of the information system in the terms of Intellectual Property Rights protection and management (Fig. 2).

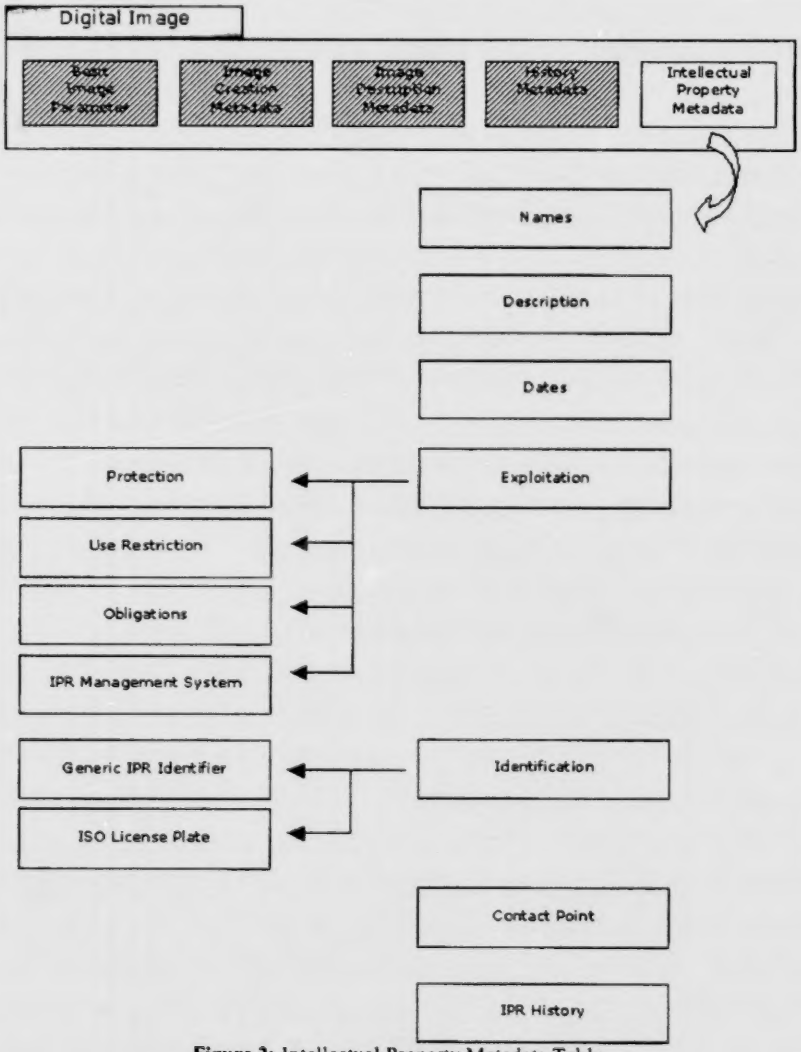

Figure 2: Intellectual Property Metadata Table

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Unique Identifiers

The unique identification of the digital images is based on the DOI (Digital Object Identifier) initiative (Pakin, 2000). An implementation of the DOI Foundation standards is provided by the CNRI Handle System (CNRI, 2001), which is the underlying technology of the Digital Object Identifier. This System enables browsers to recognize the Handle Protocol and resolve a handle to a URL. A handle is a unique identifying string that is embedded in the digital image and will be used within the framework of the Advanced Digital Image Repository, in two ways:

- As the Digital Image ID in the tables and fields of the database structure.
- As the Digital Image ID produced by a user interface for data input and submitted to the central database.

Watermarking and the Advanced Digital Image Repository

Invisible watermarks are a proposed solution for the protection of Intellectual Property Rights and for dealing with the problem of illegal reproduction of content of multimedia objects (IEEE, 1999). Numerous watermarking schemes have been proposed and implemented and the performance evaluation has resulted in the selection of the best watermarking tools for this information system (Tsolis D., 2000). These tools have been obtained in SDK (Service Development Kit) format and are being embedded in the Digital Image Repository using technologies that the database management system provides. The goal is the watermarks to be embedded in the digital images when the digital image is being stored in the central repository. This general strategic planning is focusing on:

- Central management of the watermarking process and, in the case of a distributed area dat abase network, scheduled synchronization of the databases. The watermarks should be embedded in the digital image wherever a database exists and then the images should be transferred to the central Advanced Digital Image Repository in the premises of the Hellenic Ministry of Culture.
- The watermarks should be embedded only into the high quality digital surrogates of photographs of objects of the Hellenic Cultural Heritage.
- The watermarks should carry two ID numbers. The first number, will be common to all digital images, and will identify the Hellenic Ministry of Culture as the copyright holder of the digital image being exchanged. The second number will identify the instance of the transaction, containing the digital image and the persons that are involved to that transaction. This number is a reference that points to specific IPR related information in the database. This information is stored in the table described above, which relates to the IPR metadata.
- The watermark should be robust to attacks and detect able over Internet oriented environments. This is ensured in the basis of the exhaustive evaluation, which has been conducted (Tsolis D., 2000).

This watermarking schema is being implemented via the creation of User Defined Functions (UDFs) that are available with the IBM DB2 Universal Database.

Producing XML documents from the Digital Repository

For this project the usage of XML (World Wide Web Consortium, 2001) is recommended as the standard metadata interchange format (The Apache Software Foundation, 2001). The primary reasons are:

- XML is widely adopted as an Internet-based language.
- XML is highly extensible.
- XML is device independent.
- XML is language independent.
- XML is application independent.

The primary target of the application under development is the creation of XML documents containing information of the advanced digital image repository. The XML documents are produced by user-defined SQL queries. The XML documents are based on an XML schema, which derives from the XML schema of the DIG35 Metadata Standard. The XML schema is modified in accordance with the specifications of the Hellenic Ministry of Culture. The output files are automatically populated with XML Template Files (Fig. 3). These template files interconnect the database schema and the XML schema. The presentation of the results is accomplished through the transformation of XML files to HTML, using Microsoft XSLT Processor or the IBM XML Lightweight Extractor (XLE) (The IBM AlphaWorks, 2001).

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE METADATA SYSTEM "dig35.dtd">
<METADATA TYPE = "Single" TIMESTAMP = "value" xmlns = "http://www.digitalimaging.org/dig35/1.0/xml">
  <BASIC_IMAGE_PARAM>
    <BASIC_IMAGE_INFO>
      <FILE_FORMAT>
        <FORMAT_TYPE>
          [MMDBSYS.Format(BASICIMAGE.IMAGE)]
        </FORMAT_TYPE>
      </FILE_FORMAT>
      <IMAGE_ID>
        <UID>
          [BASICIMAGE.DOI]
        </UID>
      </IMAGE_ID>
      <IMAGE_SIZE>
        <WIDTH>
          [MMDBSYS.Width(BASICIMAGE.IMAGE)]
        </WIDTH>
        <HEIGHT>
          [MMDBSYS.Height(BASICIMAGE.IMAGE)]
        </HEIGHT>
      </IMAGE_SIZE>
    </BASIC_IMAGE_INFO>
  </BASIC_IMAGE_PARAM>
</METADATA>
```

Figure 3: Sample XML Template File

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CCT: A Tool for Web-based Teaching

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Many teachers use PCs in their class because of an explosion of educational resources available on the web. Visualized web pages are good supplemental materials in the classroom. On the other hand, students sometimes browse unrelated documents behind the teacher's back. Teachers need effective tools for watching and interacting to students. There are some products that offer capability of such requirements. However, these products require special hardware and its capability is limited. Therefore, we have been developing CCT: A Cooperative Classroom Tool. CCT is based on our former research project CACCE: Computer Aided Cooperating Classroom Environment, which provides teachers to show their display to their students or vice versa. CCT includes a watching component and an instant web server component in addition to CACCE full features as a web-based presentation component. In this paper, we describe CCT overview, CCT's functions, and how it works in the classrooms.

Developing Community of Practice for Online Moderators

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Abstract: Training of online moderators is currently based on moderators' and online instructors' personal online communication skills and personal knowledge, and may result in the insufficient development, application, and dissemination of knowledge. This paper describes a CoP model that utilizes on-line elements designed to enhance the skills and professional development strategies of online moderators. It concludes with a discussion of the attributes of CoPs and guidelines for construction of effective models for the learning of online moderation.

Introduction

The use of online moderators and their importance to online instruction has been emphasized in many studies. Online moderation is one of the most critical factors affecting online interaction. The training of online moderators is based on personal online communication skills and personal knowledge of moderators and online instructors. However, this process may result in the insufficient development, application and spread of knowledge. Online moderators are seeking different resources to support and enhance their moderating skills and strategies, but these isolated approaches have limited their professional development and are based upon a self-learning approach. Communities of practice (CoP) have the potential to be conducive to mastery of new knowledge, a concept supported by successful reform projects (National Science Foundation, 1997; Stokes, Sato, McLaughlin, & Talbert, 1997). This paper describes a CoP model that utilizes on-line elements designed to enhance online moderators' moderation skills and professional development strategies. The goal of this project is to evolve a sustainable CoP for online moderators involved in the instruction of professionals, learning the intricacies of their profession, implementing practices, and applying new content knowledge. The Online Moderation Community Project demonstrates how a CoP model supports and enhances online moderators' moderation learning and skills. The preliminary data from this project are reported in this paper. It concludes with a discussion of the attributes of CoPs and preliminary guidelines for construction of effective models for the learning of online moderation. Developing an ideal community of practice requires time, therefore, the data collection for this particular project is an ongoing process.

Quintessentially, "communities of practice are groups of people who share similar goals and interests; and, in doing so employ common practices, work with the same tools and express themselves in a common language. Through such common activities, they come to hold similar beliefs and value systems (Collaborative Visualization (CoVis) Project, 2000)." These groups of professionals are informally bound to one another through exposure to a common class of problems, a common pursuit of solutions, and embody a store of knowledge (Peter+Trudy Johnson-Lenz, 2000). A common sense of purpose and a real need to acquire the knowledge each possesses holds these professionals together. Members of a CoP collaborate directly, use one another as sounding boards, and teach each other. They are not merely peers exchanging ideas who share and benefit from each other's expertise, but members committed to the joint development of better practices; therefore, a "community that learns" is developed rather than a simple "community of learners."

Online moderation community at ETL

The community of online moderators is setup as an entirely asynchronous "Online Moderation Forum." The community is composed of nine course moderators in the Educational Technology Leadership (ETL) masters program at George Washington University (GWU). Course moderators are known as section leaders (SLs) and are graduates of the ETL program. The responsibilities of SLs are to assist students in their learning process by moderating online discussions, answering students' course-related questions and promoting higher levels of online interaction, etc. Participation in the NetForum, an online bulletin board system used for communication among members of the community is voluntary; however, a facilitator, a faculty member at the ETL program, solicits active participation. This faculty member serves as the coordinator and facilitator. The forum runs throughout the year and is not interrupted by semester breaks.

The community does not have a fixed agenda. The idea is to create a community to share and exchange knowledge on the subject of online moderation and to apply their knowledge to the practice of online moderation for ETL courses. However the community is expected to provide more than just a forum for information exchange. Different types of online activities are applied to foster the development of an online learning community, such as guest speakers, discussing current critical issues in online moderation, social conversation...etc. A preliminary model is borrowed from COP guidelines developed by Tu and McIsaac (2001) to enhance interaction within the online community.

Four COP guidelines are adopted from previous studies (Tu & McIsaac, 2001): (a) determining what knowledge the community is to share is the first step of the CoP building process. (b) Clearly defined community knowledge must be declared although the CoP is formed naturally and socially. Organizations frequently cast "too wide a net" and ask teams to share or document too much information. As a result, they end up building stockpiles of underutilized information. (c) Sharing insights is not simply a matter of transmitting information from one person to another. (d) All of these SL's discussions are relevant to their practice; therefore, this effectively "pulls" new set knowledge out of community members. (e) A workplace should value learning and sharing knowledge, it should provide "fertile soil" for growing CoPs.

Conclusions

Community of practice can enhance learning through natural online social interaction. Several factors identified in this study serve as a preliminary model for building a CoP for online learning. First, one must decide what kind of connections to make between learners, to understand what kind of knowledge to share; what kind of community it is inclined to be; and how tightly sharing knowledge needs to link with work. CoPs arise spontaneously in most organizations obviating the need to create and build them from the ground up to enhance learning. However, one needs to identify and nurture them with the rich resources, the proper structure, and the flexible systems they need to flourish, developing CoPs is closer to husbandry than to architecture.

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Constructivist Activities

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Abstract: Constructivism is a relatively new idea to education and especially educational technology. For many people constructivism represents a new way of conceiving the educational experience, it is about how people naturally come to know information that is being passed on. In constructivism learning is unstructured, self-directed and happens through discovery. The method emphasizes students' ability to solve real life, practical problems. In this model, students construct knowledge themselves rather than simply receiving it from teachers. Students work in cooperative environments rather than individually and they tend to focus on projects that require learning of certain skills.

Constructivist learning is based on students' active participation in problem-solving and critical thinking regarding a learning activity which they find relevant and engaging. They are "constructing" their own knowledge by testing ideas and approaches based on their prior knowledge and experience, applying these to a new situation, and integrating the new knowledge gained with pre-existing intellectual constructs. (Piaget, 1970) Some of the needs addressed by constructivism can be defined as follows:

- Making skills more relevant to students' backgrounds and experiences by anchoring learning tasks in meaningful, authentic and highly visual situations.
- Addressing motivation problems through interactive activities in which students must play active rather than passive roles.
- Teaching students how to work together to solve problems through group based, cooperative learning activities
- Emphasizing, and engaging, in motivational activities that require higher-level skills and prerequisite lower-lever skills at the same time.

Therefore, constructivism calls for teachers to rethink traditional views and to experiment with new ways of facilitating students' learning. Technology is a great to help to develop constructivist skills. On the other hand, the ways in which teachers use technology are as varied as the teachers themselves. The school of thought and the philosophy of the teacher will influence the way in which technology is utilized by the teacher. In the constructivist view, teachers have to permit students to explore and investigate areas of knowledge. They have to find ways to let the learner take control and explore the questions of particular interest to that individual. In general through proper implementation of technology it is possible to pose a problem or define a question that could be pursued by the student in a creative and exploratory style. Then it is the teacher's responsibity to guide the student in this exploration and develop the notion and wisdom of sharing the knowledge with others.

There are many ways to develop constructivist activities. Especially with the use of technology they can become more effective. Some examples of these can be simulations, Internet projects and Internet field trips. The student is pursuing a problem or activity by applying approaches he or she already knows and integrating those approaches with alternatives presented by other team members, research sources, or current experience. Through trial and error, the student then balances pre-existing views and approaches with new experiences to construct a new level of understanding. In constructivism, learning is then assessed through performance-based projects rather than through traditional paper and pencil testing. (Jonassen et.al, 1998)

In short, technology is one of the major parts of the educational reforms today. We know that now computers can enhance and change the way subjects are taught. Constructivism is one of the most effective methods to infuse technology and help learners to explore information out and grasp what they need.

In this presentation, some examples of constructivist activities will be demonstrated and discussed.

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Evaluation of Web-based Training Design Features by Job Classification

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Abstract: An on-line Web-based training (WBT) evaluation was developed at Los Alamos National Laboratory to measure adult learner preferences of WBT design features. The evaluation was developed for a new waste management course that targets approximately 4,000 employees. The target audience is composed primarily of three job classifications of workers: technical staff members, specialty staff members, and technical support employees. This research was designed, in part, to ascertain the preferences of WBT design features based on job classification. Trainees are asked to rank WBT design features on a scale from 1 to 5, with 1 being "very unimportant" and 5 being "very important." The six WBT design features that are being evaluated include provision of job resources, entertainment, media, interactive exercises, ability to take the online quiz at any point during the training, and relevancy of the training to the job. To date, of the approximately 350 trainees that have received credit for the training, 144 have completed the on-line evaluation. Preliminary results indicate that there is no significant difference in responses by job classification as to the preference of WBT design features. Preliminary results also indicate, without reference to job classification, that the three WBT design features deemed relatively most important are the provision of job resources, ability to take the on-line quiz at any point during the training, and relevancy of the training to the job. As the number of respondents to the on-line evaluation increases, significant differences in responses by job classification may appear.

Introduction/Background

Los Alamos National Laboratory has approximately 4,000 waste generators who are required to participate in waste management training. Training consists of an initial 4-hour, instructor-led course and a Web-based training (WBT) refresher course covering waste management compliance that is required every three years. The initial course was implemented in 1992 and the refresher was implemented in May 2001 in response to a new Laboratory training requirement.

The goal of these two courses, in concert with other Laboratory efforts, is to reduce the number of Resource Conservation and Recovery Act (RCRA) violations. The refresher course was determined to be an appropriate candidate for a WBT prototype since there is an existing initial course and background materials, a large audience, and a relatively short time duration in which all waste generators are required to be trained. Targeted trainees must complete this training by November, 2001.

This research is being conducted, in part, to determine adult learner preferences of WBT design features by job classification for the development of future WBT. The target audience for the course is primarily composed of three classifications of Laboratory workers: (1) Technical Staff Members (TSMs), (2) Specialist Staff Members (SSMs), and (3) Technical Support employees (TECs). The null hypothesis is that there is no significant difference in WBT design-feature preferences among job classifications.

TSMs are exempt employees with technical credentials as scientists or engineers who perform jobs requiring those credentials. SSMs are exempt employees in jobs with a professional or administrative specialty that require extensive knowledge in a recognized profession and a minimum education requirement of a bachelor's degree. TECs are exempt and nonexempt employees that provide technical support and expertise to Laboratory programs and organizations.

Methods

When trainees log into the Web-based course, they are automatically sent an e-mail directing them to an on-line evaluation of the course. Trainees are asked to rank Web-based training design features on a scale from 1 to 5, with 1 being "very unimportant" and 5 being "very important."

The six Web-based training features that are being evaluated include provision of job resources, entertainment, media (e.g., photos, videos, audio, etc.), interactive exercises, ability to take the online quiz at any point during the training, and relevancy to job.

The numerical values indicating importance of WBT design features were converted from a scale of 1 to 5 to a scale of 20 to 100 for the purpose of clarity and to reduce the importance of decimals. Summary statistics were calculated using basic descriptive statistics such as mean, standard deviation, and the f-test to assess validity.

Results

As of the submittal of this paper, approximately 420 trainees have received credit for the Web-based training and 168 trainees (comprised of 77 TSMs, 14 SSMs, 57 TECs, and 20 "other") have completed the on-line questionnaire. To date, there are no significant differences in the responses by job class as to the preference of WBT design features.

In analyzing the raw data set without regard to job class, the following responses were observed.

This % of Respondents...	...Rated this WBT Design Feature as "Important" or "Very Important"
73.21	Providing Job Resources (contact lists, policy documents, forms, tables, and charts)
16.07	Entertainment (the "fun" factor)
47.62	Media (text, photos, graphics, animated graphics, video, and audio)
60.71	Interactive (multiple choice, drag and drops, fill-in-the blank, hyperlinks)
76.19	Online quiz at any point (ability to "quiz-out" for course credit)
76.19	Relevance to job (relates to job-specific tasks)

Figure 1

Conclusions

Due to the infancy of the research, it is too early to make preliminary conclusions concerning the Web design preferences of trainees based on their job classifications. As the number of respondents increases, significant differences between job classifications may appear. All targeted trainees are required to take the training by November, 2001, hence, there may be a large number of responses near this deadline. Also, as more trainees respond, the percentages indicated for each design feature in the raw data set (without regard to job classification) may change. However, current data (Figure 1 above) suggests that trainees view "relevance to job, online quiz at any point, and providing job resources" as the most important WBT design features.

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Requirements Analysis and Evaluation of Streaming Technologies with Respect to Interaction in Multimedia E-Learning Courses

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Abstract: E-Learning interests and activities have steadily increased over years with technological progress. There are still many open questions and unsolved problems. Within this paper, we focus on the lack of sophisticated interaction possibilities in computer-supported educational systems. Modern streaming technologies like MPEG4 or SMIL seem to support the bi-directional exchange of information between e-learning systems and users – one prerequisite for establishing individual interaction features in multimedia learning contents. This paper presents a new requirements analysis for evaluating modern streaming technologies. In particular, interaction techniques are considered. The evaluation provides the basis for developing a highly interactive e-learning system.

Introduction

A variety of specialized authoring tools provide course authors with the capability to create electronic courses, which contain multimedia content as well as interactive elements, essential for course assessments and certification. When distributing courses over a network-based environment like the World Wide Web (WWW), some of the following problems can occur, possibly keeping potential learners from using the course.

- Learners most often need to install players, browsers, potentially plug-ins, and virtual machines before they can consume course contents.
- Transmitting multimedia information over the WWW very often requires long downloading times.
- E-Learning courses most often do not provide a way to ensure temporal synchronization of their included course elements.

To engage students in the process of learning, it is important to offer a way to gauge their progress in knowledge, expertise, and skills. Thus, developing possibilities for users to interact with the learning contents is necessary. The WWW and existing applications for e-learning systems provide several techniques for interaction. These techniques partly overlap, while there are other techniques, where the WWW and e-learning applications differ from one another.

The aim of this paper is to investigate one approach to integrate several differing techniques of interaction and to combine them with continuous, synchronized multimedia data streams. A methodical approach for evaluating and assessing streaming technologies in the field of e-learning is outlined in this paper. First, general requirements for online courses are presented, particularly focusing on the new combination of interaction techniques from different domains like the WWW and e-learning applications. Then modern streaming technologies are evaluated against these requirements. Finally, ideas for future work are presented.

Requirements analysis

Perception Requirements

Generally, multimedia content requires a concept of temporal information as a basis for mounting the elements of a presentation in the desired sequence. Usually, authoring tools comprise temporal information in the form of time stamps. Time stamps determine the appearance of the elements of a course on the timeline.

- *Temporal dimension:* Time stamps indicate the point in time, at which the associated media element has to be presented to the learner. A developer specifies the time stamp either relative to the beginning of a course or relative to asynchronous events, which occurred in the previous course progression.

Parts of relevant textual information, which are contained within a text file being referenced from within a course description, have to be adapted according to varying interests. The process of adaptation merely consists of editing the textual information, if *genuine integration of text* is supported. No changes need to be applied to the overall structure of the course, which definitely eases future reuse of existing course materials.

As stated by (Najjar 1996), it is possible to enhance the way a course is perceived by using pictorial information. Thus, a data format for online courses must first support the integration of images in a general way and must then allow displaying or hiding images at given time stamps. If the user's perception should not be obstructed, images must appear (or disappear) synchronous to the information they are supposed to support. Unfortunately, it takes a certain amount of time to load image data into computer memory, especially, if the image data is transported over the WWW. Thus, images need to be prefetched and stored on the local computer until they are instructed to appear.

- *Integration of images*
- *Preloading of images*

Audio elements very often form an essential part of the course content – be it for pedagogical or psychological reasons, or be it for enhancing the mere joy of consumption. Transmitting audio elements over the WWW can be quite tedious, since it requires a huge amount of data to be transferred, before perception (MP3EncV3.1 1998).

- *Streamed transmission of audio elements*

Frequently, course authors use videos to transport transcriptions of lectures or talks, and additionally illustrate what is being shown in the video by adding textual information, conveying the basic ideas or essential concepts (Nielsen 2000).

- *Streamed transmission of videos*

Interaction Requirements

Besides the requirements outlined above, other requirements relate to the capabilities of learners to interact. The following provides examples for typical ways of interaction with e-learning courses and outlines the interaction techniques used to realize the given ways of interaction.

Several forms of user interaction can be performed by means of *buttons* and *hyperlinks*. In the following examples for user interaction by hyperlinks are listed:

- *Single Choice*: Learners need to answer questions by selecting one answer from a set of possible answers.
- *Hyper linked explanations*: Abstracted concepts are represented by pictorial elements in diagrams. By using mouse clicking on those pictorial elements, the learner is lead to a thorough explanation of the given concepts and is thus provided with comprehensive, detailed information, while still working with a plain and easy to learn diagram.
- *Extended navigation:* Navigational instruments allow jumping within a given course or between several courses. Users are able to skip parts of online courses when they are currently not interested in details of the enclosed content.
- *Multiple Choice:* From a set of possible answers, at least one answer needs to be selected. In the course of this paper, multiple choice interaction is considered to differ from the other forms of interaction listed above. It is required to store and process more than one single answer in a data structure in order to assess multiple choice tests. This augments the functionality of buttons and hyperlinks, which are

usually not provided with an underlying data structure, storing the results of previous user interaction. Therefore, multiple choice interaction is treated as an evaluation criterion in its own right.

Text input fields allow for answering questions in a complex form or for realizing ways of collaboration between learners. Following, examples for using text input fields are given.

- *Editorial Comments*: Learners are asked to answer questions in a prose form.
- *Annotation*: The user is able to make notes on given pieces of information.
- *Collaboration*: To perform a given task, learners need to collaborate by means of textual input.

Drag and Drop interaction allows elements to be dragged across the computer screen and be assessed with regard to their final location on the screen. An example for drag and drop interaction is given hereinafter:

- *Adjusting the position of elements*: Pictorial elements are displayed on the computer screen. The user has to move them from the position of first displaying to another location on the computer screen, which the user assumes to be the correct destination.

Summarizing, requirements concerning the following fields have been identified as listed in (Tab. 1).

Perception	Interaction
Temporal dimension	Buttons and hypertext
Textual information	Multiple choice interaction
Images	Text input fields
Streaming Audio	Drag and drop interaction
Streaming video	

Table 1: Results of the requirements analysis: Separated by requirements, which concern the way users perceive the contents of the course, and requirements concerning interaction capabilities.

Evaluating Streaming Technologies

Several existing technologies support the realization of e-learning courses. Among them are the XML based SMIL and SVG, MPEG-4, Macromedia Flash, and the Java programming interface for multimedia presentations JMF. Those streaming technologies providing the greatest extent of support for the formulated requirements will be described below: SMIL, MPEG-4, and Macromedia Flash. SVG is not described within this paper, since it is no actual streaming technology, but mainly a description language for two-dimensional vector graphics. JMF is a collection of Java classes for programming an entire application, that allows for streamed presentations and therefore cannot be compared to its 'competitors' in a consistent way.

Synchronized Multimedia Integration Language SMIL

SMIL is a XML based language for the creation of multimedia presentations, which integrate streaming audio and video with images and text. Basic concepts, as well as the terminology used with XML are specified in (XML 2000). A SMIL file comprises XML elements in plain ASCII mode defining the media-elements that shall occur at given points in time. A SMIL player interprets the contents of the SMIL file and fetches media elements as necessary, in order to render them, following the author's specifications. At the time of writing this text, no free players supporting SMIL2.0 are available. There are several free SMIL 1.0 players available now. An accurate and up to date list of players can be retrieved from the WWW site of the World Wide Web Consortium (W3C) http://www.w3.org. In the following, some results of the evaluation of SMIL are summarized. By means of the SMIL specifications (Hoschka 1998) and (SMIL 2001) and test implementations it has been investigated how SMIL1.0 and SMIL2.0 meet the requirements. An overview of the results of the evaluation is given in (Tab. 2). In the following, some facts are outlined, which describe more thoroughly some aspects of the evaluation of SMIL.

- *Temporal dimension*: The attributes 'begin', 'end', and 'dur' (i.e. duration) can be alleged to each SMIL element conveying audiovisual or textual information. A SMIL player can also be instructed to start an action relative to the starting or ending time of other elements or relative to an event such as a mouse click.
- *Textual information*: Texts can be fetched from external files or contained within the SMIL code.
- *Buttons* and *hyperlinks*: Buttons and hypertext can be realized, by placing hyperlinks 'around' visually perceptible elements (i.e. text fields, images, and frames, containing video streams or animations). The syntax of hyperlinks is similar to that in HTML documents (Raggett & Le Hors & Jacobs 1999). Going beyond the capabilities of HTML, SMIL hyperlinks can contain an attribute 'show', which designates how the hyperlink shall be traversed (e.g. open another instance of the SMIL player or pause the current part of the presentation until the user returns to it).

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- *Multiple choice, text input, drag and drop*: SMIL does not support a way of interaction where several results of user interaction are collected and then evaluated as a whole (contrary to, for instance, HTML forms). Therefore, multiple-choice interaction is not supported by SMIL1.0. In addition, text input and dragging and dropping of visually perceptible elements is not supported. But starting from SMIL2.0, more advanced interaction features will be integrated: SMIL2.0 will allow for event-triggered interaction and animation, which offers a way to realize drag and drop and multiple choice interaction.

Macromedia Shockwave File Format

The Macromedia Shockwave file format (SWF pronounced 'swiff') had been developed for the transmission of vector graphics and animations over the WWW. The syntax of SWF has been published in (Evans 2000). A collection of C++ classes encapsulating the creation of the binary SWF 'tags' is available free. Documentation and software can be downloaded from the homepage of Macromedia http://www.macromedia.com. The overall evaluation results are listed in (Tab. 2). In the following, some of the evaluation results of SWF are outlined in more detail.

- *Temporal dimension*: SWF does not genuinely possess a time concept. Utilizing a characteristic of SWF can simulate a certain 'notion of time': Adding so-called empty frames to a SWF stream does not influence the visual representation on the screen but requires a certain amount of time (1/25 of second under ideal conditions). By this, a way is offered to implement time stamps, in that the number of frames in a stream determines the temporal dimension of an online course.
- *Textual information*: SWF does not support text strings directly, but assembles texts from arrays of glyphs (i.e. coded definitions of the visual representations of characters). Thus, SWF does not well support composition, maintenance, and reuse of texts.
- *Streaming video*: SWF merely simulates streaming video by decomposing video clips into single frames and transmitting them as continuous stream of individual, separately encoded images.
- *Multiple-choice interaction* and *text input*: Events, triggered by user interaction, can cause updating of a SWF variable. The value of a variable can either be directly processed by the SWF player or transmitted to an address on the WWW for further processing. Thus, multiple choice as well as text input can be realized with SWF.
- *Drag and drop interaction*: This form of interaction can be realized by continuously tracking events generated by the motion of the mouse pointer. The position of a visually perceptible object is dynamically changed, according to the mouse motion.

MPEG-4

MPEG-4 is an ISO/IEC standard (ISO-IEC FDIS 14496) for encoding audiovisual objects for streamed transmission over networks or broadcasting. Audiovisual objects are transmitted in so called elementary streams, whereby one stream contains one representation of an object in a binary code. As textual representation for MPEG-4 the eXtensible MPEG-4 Textual format (XMT), which is described in (Kim 2000), has also been defined. XMT is a text-based, human readable description framework for MPEG-4 scenes. XMT uses parts of the specification of SMIL2.0. Elements, which XMT and SMIL2.0 have in common, belong to the fields (aka SMIL2.0 'modules') timing and synchronization, linking, animation, and content control. Therefore, the results of the evaluation of MPEG-4/XMT and SMIL partially overlap. At the time of writing this text, a preliminary specification of XMT exists. Thus, the specification may change partly in the future, making a re-evaluation of MPEG-4 necessary.

In the following, some specific aspects of MPEG-4 concerning the evaluation are recapitulated. The overall results are given in (Tab. 2).

- *Images*: MPEG-4 allows integrating different versions of an image, whereby each version can be optimized for different network conditions, selected quality, or regional settings. At least one individual stream embeds one (version of an) image. The same applies to any audio-visually perceptible object analogously.
- *Multiple-choice interaction*: Generally, MPEG-4 integrates great support for all forms of interaction by specifying an interface of MPEG-4 players with Java code (MPEG-J). Java code is transported in an individual stream and interpreted by (an independent part of) the MPEG-4 player. MPEG-J generally allows augmenting interaction capabilities, thus providing support for programmatically implementing multiple-choice interactions.
- *Text input fields*: It is required for MPEG-4 to maintain ways to obtain user input from diverse hardware devices, such as computer keyboards. Thus, MPEG-4 supports text input.

- *Drag and drop interaction*: One fundamental navigation mechanism, MPEG-4 supports is to drag objects in a scene. It is therefore possible to realize advanced drag and drop interaction with MPEG-4.

Summary and Result

The overall results of the evaluation are given in (Tab. 2). All technologies evaluated support the evaluation requirements largely. A decision, which technology to use can therefore not only depend on the mere results shown in the table.

A fundamental criterion is how a working technological framework supports streaming technologies: Are there applications and tools available, with which a presentation can be rendered, edited or interchanged? It turns out that software manufacturers currently largely support only SMIL and SWF. There is a range of established and working applications, allowing for distributing und viewing SMIL and SWF content.

Additionally, it is important to consider how relevant each individual requirement is in a given context. It is outlined in (Ley & Ulbrich 2001) how the decision-making process is influenced by the importance (i.e. weight) a requirement possesses. Most relevant for online courses have been the following: Integration of a temporal dimension, support for images, text, and audiovisual elements, and the possibility to realize buttons and hyperlinks. Only SMIL and MPEG-4 fulfill these requirements entirely.

Considering these arguments, it appears that SMIL is the most applicable streaming technology for online courses. It fulfills those requirements best, which are assumed to be of great importance and will prospectively fulfill – with the upcoming SMIL2.0 – most of the other requirements. Additionally, it can be assumed as safe that the W3C will continuously adapt SMIL in order to integrate more elaborated functionality. Thus, adopting SMIL will presumably not lead to a situation, where the technological progress overtakes the work executed, while at the same time assures that an existing framework of software allows instantaneous distribution and consumption.

Requirement	SMIL	Macromedia Flash	MPEG-4
Temporal dimension	Supported	Not supported	Supported
Textual Information	Supported	Not genuinely supported	Supported
Integrating images	Supported	Supported	Supported
Preloading images	SMIL2.0 only	Supported	Not genuinely supported
Streaming audio	Supported	Supported	Supported
Streaming video	Supported	Not genuinely supported	Supported
Buttons, hyperlinks	Supported	Supported	Supported
Multiple choice	SMIL2.0 only	Supported	Supported
Text input	Not supported	Supported	Supported
Drag and Drop	SMIL2.0 only	Supported	Supported

Table 2: Results of the evaluation of SMIL, Macromedia Flash, and MPEG-4

Future Work

The upcoming specification of SMIL2.0 will be examined thoroughly. It is of great interest to pursue the support for advanced interaction features of SMIL2.0 in order to integrate them into e-learning applications. Additionally, it shall be investigated, what new forms of interaction, which have not been thought of yet, SMIL2.0 allows. In parallel, the forthcoming development and standardization process of MPEG-4 will be observed. The partial parallels between SMIL and XMT make it appear to be sensible to follow this approach.

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Two Years "Down the Road": Evaluation of Web-based Training with Remote Controlled Coaching and Assessment

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Abstract. Web-based or networked training systems have evolved in the past few years to a point where evidence exists that these systems efficiently support both instruction and skill development processes. This report presents an evaluation of a two year study of a state government agency that has implemented training utilizing Web-based content. Additionally, synchronous (same time, any place) coaching and performance assessment are employed through remote control access combined with telecommunications. The instructional design for Web-based training described in this study has applications within the broader education community, which includes the augmentation of distance education courses that require computer or software skill demonstration by the learner.

Introduction

The Texas Animal Health Commission is a small state agency that includes laboratory personnel, field inspectors, veterinarians, and support staff. The Agency is responsible for a range of programs and activities that include the surveillance, prevention, diagnosis, and control of livestock diseases and other threats such as bioterrorism.

Results of the agency's 1998 *Information Systems Risk Analysis* identified several training related problems: (1) inequities in Career Ladder training resulting from the lack of Information Resources and Human Resources staff and (2) high cost of providing face-to-face training to regionally dispersed personnel. Chief complaints from employees were: (a) that training time (in-house courses were four to six hours duration) was not sufficient to learn the new skill, (b) that the abbreviated content of the training was not readily transferable to the job, and (c) that training was either not scheduled frequently enough (a complaint from both regional and central offices) or conflicted with other work requirements. The widely dispersed nature of employees and assets, combined with the small size of the Agency, places a substantial burden on training resources. Mandated training (e.g., sexual harassment prevention), workplace safety training, and Career Ladder training combine to place a significant burden on the allocation of resources required for the agency to fulfill training obligations.

Web-based Training as a Possible Solution

Web-based training has been evaluated by various state agencies. One experience introducing an online training solution for the Texas Natural Resources Conservation Commission (TNRCC) was reported by Walker (Schreiber & Berge, 1998). The TNRCC is a large State agency with approximately 3,000 staff, of which 700 are dispersed in regional offices. The attempt to introduce skills training with online technology demonstrated a significant benefit/cost ratio and return on investment. However, the delivery of online courses (as reported) was short-lived. Many of the problems that motivated the TNRCC to explore the delivery of Web-based training (cost of face-to-face delivery, lack of training personal, lack of time, and a widely dispersed staff) are compounded in a much smaller agency. Several organizational advantages that seem possible with Web-based training include:

- *Equitable training.* Personnel in the area offices and satellite laboratories do not have easy access to face-to-face training courses held in Austin, restricted by time and/or by budget. Web-based training is available any time, any place removing the inequities in training accessibility.
- *Decreased travel costs and trainer time.* Out-of-town trips and overnight stays by IR and HR personnel to conduct half-day courses is dramatically reduced. Also, trips to Austin by area office and laboratory staff can also be significantly reduced.
- *Flexible scheduling.* Web-based training courses are self-paced and available 24 hours a day. Synchronous coaching is available through Timbuktu remote control and telephony on a scheduled basis, but at times convenient to the trainee, the coach (trainer) and the trainee's supervisor.
- *Flexible content.* By requiring skill set assessments for Web-based courses, these courses can be customized so that users can by-pass sections that do not apply to their jobs.

What the Pilot Study Suggests

The Agency's laboratory staff (25 personnel at four different locations) was selected for the Web-based training pilot study. Commercially available Web-based training courses were selected. Web-based training was augmented by synchronous coaching (guiding the learner through problems encountered during training) via the remote control Timbuktu Pro software and telephony or telephone communications. The instructional design also included skill sets for which the employee must demonstrate proficiency in order to achieve training certification. At the conclusion of a two year pilot study several aspects of Web-based training need to be addressed as the agency moves to involve more staff. The more significant needs are:

- The use of synchronous coaching using Timbuktu remote control and telephony was negligible. However, while at work the participants would help each other resolved the majority of questions that would arise with a particular application. Only twice was coaching requested. Ways to increase the opportunity for coaching (expert feedback) without discouraging collaboration are being considered.
- Courses other than those required for training were accessed by 80% of the staff. Some of the "extra curricular" courses were completed, others only partially attempted. Activity beyond the required courses could be considered positive motivation with regard to the online course.
- Each participant had to complete the required skill set with the course administrator via the Timbuktu-telephone remote control link. These scheduled sessions were conducted without problem.
- Further study will incorporate Kirkpatrick's (1998) four levels of evaluation. Several participants have used the training to develop improved data reporting and communication procedures. It was discovered that most of the participants accessed the courses from their home PCs. This means that some of the training was done on their own time, although this was discouraged from the outset. Since this time was not compensated, the staff involved were questioned why they would rather work at home than at work. The answers involved the convenience, privacy, and independence that working at home afforded, a response identified with adult learners (Knowles, 1990).

Costs Savings: A Preliminary Analysis

A preliminary analysis comparing time and expense categories associated with Web-based training and with face-to-face training is being conducted. However, costs associated with face-to-face training compared to Web-based training can be estimated. What would be required to provide equal and timely training (only 3 courses per year) to 60 remote employees (distributed over the State in regional offices and laboratories)? To accomplish the agency's goal that training is equally accessible to all employees, an additional full-time training staff member would have to be hired ($45,000), and an additional $17,500 added to the travel budget if face-to-face training were to occur. Looking at the training costs on an individual basis: $1,042 per employee for face-to-face training versus $93 per employee with Web-based training. Although these figures are estimates and incomplete, they are in line with the savings reported by Walker (page 283) for TNRCC (a return on investment of 275% and benefit/cost ratio of 3.75:1).

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Putting One School on the Web
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Abstract: In the fall of 1999 the authors began collaborating on the development of curriculum for a pilot high school multimedia and graphic design course. Two of the successes of this project were the integration of web design and the maintenance of the school web site into the curriculum for the course. Efforts are now underway to encourage K-12 teachers throughout the school to utilize the course as a resource for placing curriculum on the web. This paper discusses the development of the school website through the course, successes and difficulties encountered along the way, and plans for future development
Fate brought us together. In 1998, Petrelius was teaching band and home economics; Ureel was working as a software engineer and planning to attend Michigan Technological University (MTU) for graduate school. Both applied for a new National Science Foundation (NSF) grant that put graduate students with little or no background in the field of education, but solid experience in science or technology, into K-12 schools as an experiment in technology transfer. In our case, the experiment continues to be a success.

Introduction

The Graduate Teaching Fellowships in K12 Education (GK12) program is funded by the NSF and administered by universities around the country. Michigan Tech administers the program in Michigan's Copper Country Intermediate School District (CCISD.) Chassell Township Schools have participated in the program since 1999.

In the first year of the GK12 program, Chassell participated with the goal of developing computer-based technology curriculum. One of the achievements that year was the successful piloting of a new course in multimedia and graphic design. This paper discusses one aspect of the course: the development of curriculum surrounding and the development of a student-maintained school website:

http://www.ccisd.k12.mi.us/chassell/

This paper is organized as follows. First we provide background on Chassell's multimedia class. We go on to discuss the development of the school web site. We describe how the course has continued to develop in a second year of the GK12 program. Finally, we summarize the results of the program and discuss future directions for the project.

Background

Chassell is a small class D high school with 120 kids grades 7-12. Chassell's computer lab had been put together in 1998 with funds from a Technology Literacy Challenge Fund Grant, but no curriculum was in place to make use of the computers. At this time Petrelius, who had used Apple II computers to support her band class, was asked to teach an upper-level computer class.

Ureel participated in the program as a GK12 Fellow in Michigan Tech's computer science department and was assigned to work with Petrelius at Chassell High School. As a fellow he developed activities and curriculum related to computer technology for students in grades 6-12. Topics ranged from computer careers to algorithms and programming to web design, multimedia, and graphic arts.

At that time, Chassell was part way through the first quarter of classes in fall 1999 when the GK12 program started. Chassell was piloting their first computer classes.

When the multimedia course started there was no existing web site for the school. Part of the justification for the course was that it should create the web site. The web site was necessitated by various grant requirements that mandated the grant information be posted online.

The Web Site

Initially students developed a web page for the school band as a proof-of-concept. The band web page consisted of pictures and even a recording of a performance at a state competition.

The proof-of-concept being successful, the class embarked on the main page design. In the pilot year of the course students posted the grant information and also information about student activities such as basketball games.

The focus of the multimedia course is to teach graphic design skills and multimedia development. We utilized the web site development as an activity to hone student design skills. At first students designed web pages with gaudy backgrounds, a multitude of animations, and background sounds. They appreciated the web page for its content and thought the bells and whistles were ways to make the page "even cooler".

As the course proceed and students became proficient in different facets of graphic design, they began to realize that the effects they initially thought would draw attention to a web site in actuality made the web page difficult to view, horrible to download, and distracted people from the main content rather than enhancing it. As the students discovered this, the web site became more elegant and usable.

The pilot run of the course was considered a success and the class was renewed for the following year. In the 2000-2001 school year more time was allocated to teaching web development. Students interviewed teachers and set up a web page for each of the teachers with the teachers email address posted. Many parents have commented about how wonderful it is that they can now easily keep in touch with teachers via email through their browser. A page for each course was set up. The activities pages were been expanded. And links were included to student-safe search engines and email.

We developed a curriculum page for the multimedia course and began posting homework assignments on the web. These assignments are on the Chassell web page at

http://www.ccisd.k12.mi.us/chassell/assignment

A lesson repository can be found at

http://www.cs.mtu.edu/~lcureel/design/

An initial barrier to placing the assignments online was the seemingly overwhelming amount of work and time it was thought this would require. What was discovered was that a template could be made to expedite the design process.

Two approaches were taken to developing templates. Petrelius used Microsoft FrontPage to quickly prototype pages and templates. FrontPage offers the option of storing a web page as a template that can be easily modified time and time again. Ureel developed HTML templates in a text editor like notepad or teachtext. He would then edit the template file – inserting the new HTML code – and save the result as a .html file.

There is still a lot of effort involved and the task is daunting if an entire course curriculum is undertaken at one time. We discover that it takes very little time to post curriculum pages and assignments as they are needed. Finally, once they are online, the successful assignments can be reused at zero time-cost.

A workshop is being planned for May 2001 to teach teachers at Chassell how to put their curriculum online. This paper will summarize the results of that workshop.

Results (So Far)

The Chassell multimedia class was a big success. Among their successes have been production of a bimonthly school newsletter, design of sports programs, and development of the school web site. We learned that students needed to know little HTML and could develop impressive web pages using tools such as FrontPage or Composer. We learned that a major part of flying a successful web site is providing support and education to teachers. We learned that simple pages work best and are the most likely to work in multiple browsers. Perhaps most important, we learned that we can set a high expectation level for students using technology and they will still exceed our expectations.

A Look to the Future

The multimedia class already has 24 kids signed up to take the course during the 2001-2002 school year. We plan to assign these students to interview teachers about their curriculum, post web pages for each course in the school, and provide support to the teachers so the teachers can post assignments and tutorials online.

Chassell also plans to utilize E-class Grades to distribute grades to students and parents.

A group of students will be given independent credit to act as technology assistants. These students will assist teachers in using computers in the classroom. This includes hardware troubleshooting and problem solving as well as software reviews, web site and presentation development.

We would like to combine digital video and multimedia to develop a video history of Chassell to run on a local television station. We would also like to create an online/CD-ROM based interactive multimedia production to accompany the program.

Development of Web-Based Instructional Tool and Online Educational Materials of the Third Generation

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Abstract: The world market of online education and training estimated to be worth $19 million in 1995, is projected to be about $54.1 billion by 2006. The vast majority of the U.S. educational institutions actively use various Web-based instructional tools (WBI tools) of the 1st and 2nd generations for a design and development of Web-based curricula and courseware. However, the leading U.S. institutions such as Stanford University, Carnegie Mellon University, University of Massachusetts, University of Michigan - Ann Arbor, recently designed, developed, and started to actively use the WBI tools of the third generation in order to support the Web-Based Education (WBE) in their institutions. This paper is a report on WBE-related activities at Bradley University, Peoria, IL, particularly, on 1) design and development of the Web-based instructional tool of the third generation, and 2) development of online academic courses in various areas.

Introduction

Studies (Russel 2000) show that "WBE students perform as well as, or better than, those in classrooms" [1]. "Participation increases, retention is higher, and they're prone to express their ideas more often and in greater depth. WBE instructors are able to offer more personal and detailed guidance than in a traditional classroom, and they can do it unbound from a strict class schedule" (Martin 1997). Experts say that 1) the number of WBE students will more than triple in the next three years, and 2) the cost of WBE may be as low as 25% of a traditional classroom-based education (CBE). This motivated Bradley University faculty and members of the InterLabs Research Institute at Bradley University propose, design, develop and test the multifunctional tool of the third generation and design and develop about 20 innovative online courses based on that tool.

Three Generations of Web-Based Instructional Tools

Between September 1999 and May 2001 the members of the InterLabs Research Institute investigated various available Web-based instructional tools of different generations.

The ***WBI tools of the first generation*** usually include several stand-alone applications that helped faculty to design, maintain, manage, and use relatively simple WBE courses. Examples of used applications include but are not limited to 1) email lists archiving, newsgroups, and bulletin boards (Hypernews, NewsXpress, Newswatcher, Agent, Gravity, Eudora, Pegasus, etc.), 2) static World Wide Web pages (browsers: Netscape, Microsoft Internet Explorer; Web Text), 3) editors (HotDogPro, Visual Page, etc.), 4) text-based conferencing tools (iChat, HyperChat, Palace, TeleCafe, Active Worlds, etc.), 5) online file repositories (Fetch, WS-FTP, CuteFTP), 6) audio-only and audio/video conferencing (VDOphone, Internet Phone, WebPhone, CU-SeeMe, Big Picture, VideumConfPro, etc.), 7) whiteboards (Microsoft NetMeeting, Netscape Conference - part of the Communicator), 8) special application environments (various Java applets, Java Applet Review Service, Gamelan, etc.).

The ***WBI tools of the second generation*** are advanced integrated tools that usually contain multiple useful for WBE functions and features such as 1) instructor's tools for WBE course planning, design, development, management, modification, etc.; 2) student's tools for self-assessing, online testing, progress tracking, building of online study skills, etc.; 3) management tools for automated calendaring and automatic reminding, student activity reports, student class lists, etc.; and 4) WBE administrative tools. The appropriate examples may include but are not limited to the following tools (McCormack and Jones, 1998): AuthorWare, BlackBoard, ClassWare, Convene, CourseInfo, Director, FirstClass, Collaborative Classroom, FrontPage, Intrakal, Learning Space, MentorWare, Nicenet, ToolBook II, TopClass, Virtual-U, Web Course in a Box, WebCT, Webmentor Enterprise, and multiple other tools.

The ***WBI tools of the third generation*** strengthen the features of WBI tools of second generation and add multiple communication facilities for online audio-, video-, and data-conferencing over the Internet. Usually, tools of the third generation provide the following additional functions: a) displaying of streaming (online) or pre-recorded (offline) video- and audio, b) displaying of rich PowerPoint presentations, and, c) control functions (or, VCR control buttons) for both audio/ video fragments and PowerPoint slides. The appropriate examples may include but are not limited to the following tools (Brusilovsky, 2000): JITL, Stanford Online, MANIC, CALAT, AOF, Sync-O-Matic 3000, WLS, MStar, CLassroom 2000, KMi Stadium, CA309, and other tools.

Web-Based Instructional Tool and Pilot Online Courses at Bradley University

The INTERLABS WBI tool contains multiple features and functions of the WBI tools of the third generation. However, the INTERLABS tool also offers the additional, attractive for both students and faculty, features such as: 1) multiple "student-to-student' and "student-to-teacher" communication functions such as "call an audio-conferencing", "call a video-conferencing", "call a data conferencing", "send an email", "join a discussion group", etc., 2) control functions to download entire course and/or a set of modules of a course from the Internet (e.g., the Interlabs Server). The distinctive feature of the INTERLABS tool is that it may be used in both synchronous and asynchronous modes, specifically: 1) in **online mode** it uses the Microsoft Windows Media Player Active X control, Microsoft PowerPoint Player, Java Script, frames, Microsoft NetMeeting SDK, and several other tools, and 2) in **offline mode** it uses the Microsoft Windows Media Player Active X control, Microsoft Visual Basic, and other tools.

In February – May 2001 Bradley University faculty created various pilot online courses and modules based on the INTERLABS WBI tool. For example, 1) Dr. Chris Kasch (Communication) developed the "Realizing the Information Future" course (COM399), 2) Dr. Vladimir Uskov (Computer Science) – "Information Systems Design and Analysis" (CS403), 3) Dr. William Polley (Economics) – "Economics Online" (ECO222), 4) Dr. Don Schertz (Electrical Engineering) – "Digital Systems" (EE566), 5) Dr. Thomas Palakeel (English) – "Literatures in Asia" (ENG381), 6) Dr. Stacey Robertson (History) – "Woman's Suffrage Movement" (HIS304), 7) Dr. Richard Stalling (Psychology) – "Social Cognition", 8) Prof. Chuck Brawner (Sociology) – "Nineteenth-Century Positivism" (SOC390), 9) Prof. Liz Cram (Nursing) – "Peripheral Vascular Disorders" (NUR202), 10) Prof. Jackie Hogan (Sociology) – "Sociology of the Body" (Soc100a), 11) Prof. Darrel Hedman (Computer Science) – "Introduction to Computer Information Systems" (CIS102), 12) Dr. Philip Jones (History) – "19th Century Ideology" (HIS346), 13) Dr. Bernard Zant (Sociology) – "Sociological Perspective" (SOC100b), and 14) Dr. Christos Nikolopoulos (Computer Science) – "Machine Learning, Data Mining and Applications" (CS522).

Demo versions of both the INTERLABS WBI tool and pilot online courses at Bradley University are available at http://interlabs.bradley.edu

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Applying the American Psychological Association's Principles of Learning to an Asynchronous Online Environment

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Abstract: Studies have shown that the dropout rate in distance education is higher than in a traditional classroom (Phipps and Merisotis, 1999). The dropout rates can range from 32% to 60% versus 4% to 15% for on campus classes (ibid, 1999). Why are students starting online classes and then dropping out? Could it be that we are not focusing on learner-centered principles? This paper attempts to provide a bridge between theory and practice by providing practical suggestions based upon research and experience. The American Psychological Association's (APA) principles of learning provide a theoretical framework which can serve as a basis for future research in the effectiveness of distance education. This paper will analyze 4 of the 14 principles of learning and their application to an asynchronous online environment.

Introduction

Over the past 10 years we have seen an increasing use of technology, such as the Internet, electronic mail, synchronous and asynchronous communication, and two-way audio and video in distance education. The proliferation and growth of these collaborative tools allow many instructional possibilities on the part of the distance educator. Bonk and Cunningham (1998) state, "The primary issue facing educators, therefore, is what sort of framework they will have for incorporating these tools for learning collaboration into K-12, higher education, and corporate classrooms" (p. 28).

In 1995, the American Psychological Association developed 14 principles of learning that can be applied to all learners. The purpose of these learner-centered psychological principles is to provide a framework to guide educational reform and school redesign efforts (APA Board of Educational Affairs, 1995). The principles were developed by examining a century of research on teaching and learning in many areas of psychology such as developmental psychology, clinical psychology and educational psychology (ibid, 1995). Since distance education is a type of school reform, these principles can be applied to an online environment. According to Wagner and McCombs (1995), "distance education provides a unique context in which to infuse learner-centered principles" (p. 32). Using the framework of an asynchronous learning environment, we can analyze each learner-centered principle and its relationship to the online learning environment.

Cognitive & Metacognitive	Motivational & Affective	Developmental	Individual Differences
Principle 1: Nature of the Learning Process	Principle 7: Motivational & emotional influences on learning	Principle 10: Developmental influences on learning	Principle 12: Individual differences in learning
Principle 2: Goals of the Learning Process	Principle 8: Intrinsic motivation to learn	Principle 11: Social influences on learning	Principle 13: Learning and diversity
Principle 3: Construction of Knowledge	Principle 9: Effects of motivation on effort		Principle 14: Standards and assessment
Principle 4: Strategic thinking			
Principle 5: Thinking about thinking			
Principle 6: Context of learning			

Table 1: APA Learner-Centered Psychological Principles
(APA Board of Educational Affairs, 1995, p. 6-10)

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The fourteen principles listed in Table 1 are categorized by cognitive and metacognitive factors, motivational and affective factors, developmental and social, and individual differences. "Fourteen individual statements are helpful but not enough. Teachers need assistance in identifying opportunities for the use of these principles in instruction and in evaluating their effectiveness" (Bonk and Cunningham, 1998, p. 32). The following section will look at 4 of the fourteen learner-centered principles and identify opportunities for incorporating them into an online environment.

Principle 4: Strategic Thinking

"The successful learner can create and use a repertoire of thinking and reasoning strategies to achieve complex learning goals" (APA Board of Educational Affairs, 1995, p. 7). Problem solving and reasoning are two examples of strategic thinking in approaches to learning. Learners who use strategic thinking are reflecting on the methods that they use to learn and are determining which strategies work well for them. They can accommodate their learning by observing others learn and are receptive to new strategies proposed by their teachers (ibid, 1995).

Observing strategic thinking can be difficult in an environment devoid of non-verbal cues (Palloff and Pratt, 1999). The challenge of an online instructor is to make the unobservable available for reflection. Creating electronic workspaces that allow participants to share their thought processes on a problem and also to share strategies for their learning online will help in strategic thinking. Another learning support is to provide problem-solving strategies for a new and unusual problem either via text, video, or audio to assist learners in developing new approaches for strategic thinking. Online instructors cannot assume that the learners have the necessary skills or strategies. The two-way feedback mechanism normally available to on campus instructors is radically changed in an online environment. By providing problem-solving strategies via electronic means, the online instructor can assist the learners in making the unobservable obvious.

One learner support that helps students reflect on their learning is adequate feedback based upon explicit expectations. One technique used by the author is a response rubric. A response rubric can outline the hallmark characteristics of quality contributions to an electronic discussion and provide a means by which students can make adjustments in their online participation. Timely feedback allows students to reflect on their current level of learning and make accommodations. Feedback can provide strategies or suggestions that can allow the learners to reflect on their methods for learning and make changes in their current strategy in order to be successful online.

A tactical learning strategy that is unique in this electronic age of information is digital literacy (Gilster, 1997). Bates (1997) stated that new technologies are "requiring and helping to develop new skills necessary in an information society, such as information navigation and acquisition, and analysis and application of information, and knowledge creation" (p. 101). Learners can explore issues and engage in dialog that discusses the limitations of electronic research and share strategies for improving search techniques (Gilster, 1997). Digital literacy and strategic thinking can be enhanced when learners question, search, and discover appropriate uses of electronic information (ibid, 1997).

A study prepared by the Institute for Higher Education Policy reviewed the literature in distance education to identify benchmarks for successful learning online. One of the successful benchmarks showed that online modules should engage students in "analysis, synthesis, and evaluation as part of their course assignments" (Phipps and Merisotis, 2000, p. 11). These are the hallmark characteristics of strategic thinking. Activities that incorporate this successful benchmark are activities that encourage students to reflect on peer responses, share new strategies online, and incorporate outside resources into their analyses. Collaboration among students is a key component in successful learning activities in order to minimize the limitations of the medium (Palloff and Pratt, 1999).

Bringing experts into the online classroom is another activity that will help guide students in strategic thinking. Bransford, Brown, and Cocking (1999) believe that experts are noticeably different from novices in the way that they interpret information, reason, and solve problems. Activities that use online experts or encourage students to search for online expertise will provide examples of strategic thinking. The online instructor can also be considered an expert. Encouraging the students to interact with the instructor can help students extend beyond isolated facts and into areas of application and strategic thinking (ibid, 1999). The new technologies also allow instructors to incorporate activities that can assist in strategic thinking such as expert systems and virtual labs, which provide promptings that can guide learners in their thinking process (Bransford,

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Brown, and Cocking, 1999). The prompts provided by the expert systems and simulations allow the learners to make choices and see the results of the choices in a simulated environment. The resulting consequences guide learners in their strategic thinking processes.

Principle 8: Intrinsic Motivation to Learn

"The learner's creativity, higher order thinking, and natural curiosity all contribute to motivation to learn" (APA Board of Educational Affairs, 1995, p.8). Personally relevant tasks that facilitate choice and control create an intrinsic motivation to learn. This fundamental motivation is also created by real world tasks that require creativity, curiosity, and insightful thinking (ibid, 1995).

Another successful benchmark in distance education identified by the Institute for Higher Education Policy is that successful courses are ones that require students to work in collaborative groups to solve problems (Phipps and Merisotis, 2000). Many educators believe that problem solving is the "most important and intellectually demanding learning outcome in education" (Jonassen, Prevish, Christy, and Stavrulaki, 1999, p. 49) and that meaningful authentic problem solving is critical in learning (ibid, 1999). Several studies have documented that problem-based learning can maintain standardized test scores, increase complex problem solving skills, and increase attitudes toward learning (Bransford, Brown, Cocking, 1999).

The use of a problem-based learning format at a Swedish University lowered the dropout rate from 50% to 29% in a distance education course (Adelskold, Alklett, Axelsson, and Blomgren, 1999) and virtual universities such as Cardean University, a subsidiary of Unext, are using the problem-based learning approach as the standard for all of their online offerings (Galijan, 2000, ¶5). Online instructors can incorporate a problem-based learning approach in their online courses, which can aid motivation. Problem-based learning is not a new idea but new technologies offer unique ways to introduce problem-based learning and to analyze problems. Spreadsheets, science probeware, databases, and other tools offer powerful ways to collect, analyze, organize, and study problems. Incorporating these tools in an online course is a way to incorporate problem-based learning, new technologies, and the online environment.

Collaboration is another essential way for learners to construct their own knowledge, to share with others, and contribute to a group. Online instructors can design collaborative work groups that provide opportunities for displaying work, and modeling effective online discussion behavior. When work is displayed, motivation also tends to increase (Bonk and Dennen, 1999). There are many learning supports that can be incorporated into an online environment to assist learners in solving real-world tasks and working in collaborative groups. "In order to support collaboration, learning environments should also provide for computer conferencing, chats, UseNet groups, MUDs and MOOs [multi-user virtual environments] to facilitate dialogue and knowledge building among the community of learners" (Jonassen, Prevish, Christy, and Stavrulaki, 1999, p. 56).

Real world tasks can also be aided by the technology itself. Virtual simulations provide a reproduction of real world tasks which can be incorporated in an online environment by accessing online simulations or text-based multi-user virtual environments such as MUDs or MOOs. Access to electronic real-time data is another way to increase authenticity. The ability to create webpages to share with a real-world audience can also aid authenticity with students sharing projects using the electronic posting capability of the web. Virtual simulations, real-time data, and posting webpages can assist learners in increasing their intrinsic motivation to learn by providing real world tasks that require creativity, curiosity, and insightful thinking.

Another way to increase motivation is to insure that your assessments are authentic. Electronic portfolios are one way to increase the authenticity of assessment and can be easily incorporated into an online environment. Other authentic assessments are student self-evaluations and rubrics that clearly define online participation. "If the assignments promote the use of critical thinking and are designed to be shared with the remainder of the group, then participants gain a sense of responsibility for producing pieces of learning that will be useful for the others in the group" (Palloff and Pratt, 1999, p. 147).

Principle 11: Social Influences on Learning

"Learning is influenced by social interactions, interpersonal relations, and communication with others" (APA Board of Educational Affairs, 1995, p. 9). Instructional tasks that allow for collaboration can enhance

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learning. In an interactive and collaborative community, diversity, flexible thinking, reflection, and social competence are valued (ibid, 1995).

Learning supports can create a social environment which may help overcome the nature of the medium. Unlike the traditional classroom, social interaction needs to be carefully designed and monitored by the instructor. A lack of social cues makes the online environment a challenge for both learners and teachers. It is hard to generate a sense of community and trust in an environment devoid of social cues (Mather, 2000). Communication technologies such as email, listservs, and discussion groups are limited by the nature of text-based communication. A limitation of the medium that points to the necessity of structure to create a collaborative environment is the inability of the medium to convey nonverbal messages. Online discussions occur primarily through text without the opportunity of transmitting expression, emotions, and other signals that occur during face-to-face communication (Morrison, 1992). New issues of anonymity and lack of physical cues are central to the medium, thereby influencing discussion. Participation in this "virtual community" of faceless text is a critical factor in mediating an online discussion. The online facilitator is charged with creating a sense of online community and cohesiveness in a text based medium.

Suggestions in the literature for creating a collaborative environment stress the importance of providing feedback and encouraging participation (Berge, 1995). The facilitator needs to regularly respond and provide feedback on a timely basis in order to provide guidelines in a text-based environment. Information on netiquette and emoticons can give the students guidance in interacting in a text-based medium. Rules, responsibilities, and norms for the online environment can be clearly delineated to establish a common sense of guidelines that dictate behavior in an online community of learners. Other learning supports can be provided by creating electronic spaces dedicated to social interaction such as a student union, an electronic yearbook for biographies, and an electronic coffeehouse for students to engage in social messaging. Even with the advent of sophisticated technologies, such as two-way video conferencing, the social cues are difficult to transmit. Instructors need to develop learner supports to assist in this lack of visual and social cues.

In order to encourage more collaborative work via distance learning, the instructor can establish learner supports in order to successfully establish collaboration online. One study recommends that the instructor needs to carefully structure the collaboration, set the tasks for the groups, and provide regular feedback (Dymock and Hobson, 1998). Advance planning and monitoring of the groups are vital components to insure that the groups function in a positive manner (ibid, 1998). In a collaborative study using voicemail and audioconferencing, the learners were positive in their support of collaborative learning and they believed that their learning had been enhanced (ibid, 1998).

Another way of building communities online is to create activities that rely on small groups to complete a project or solve a problem. This successful benchmark was identified by the Institute for Higher Education Policy for online courses (Phipps and Merisotis, 2000). When students work together to achieve a common goal, their learning is influenced by social interaction. "New developments in the science of learning suggest that the degree to which environments are community centered is also important for learning" (Bransford, Brown, and Cocking, 1999, p. 132). An online instructor may choose to allow students to name the community learning spaces and assign visual cues. By allowing students a role in creating the learning environment, the online facilitator creates a learner-centered community from the initial onset of a course. The instructor can assist in community building by incorporating team-building and ice-breaking activities online (Ko and Rossen, 2001). Role-playing, online debates, simulations, mentoring, and other collaborative strategies can also be incorporated into an online environment. This constructivist approach to learning uses collaboration, shared goals, and teamwork to encourage interaction and feedback among the learners (Palloff & Pratt, 1999). Because the instructor becomes more of a facilitator in an online environment, the social interaction directly contributes to the learning that occurs.

Principle 14: Standards and Assessment

"Setting appropriately high and challenging standards and assessing the learners as well as learning progress – including diagnostic, process, and outcome assessment – are integral parts of the learning process" (APA Board of Educational Affairs, 1995, p. 10). In order for effective learning to occur, both formative and summative assessments need to be conducted. Standardized assessments, performance assessments, and self-assessments all impact student learning and can provide information about learning outcomes (ibid, 1995).

Many technology tools are available that provide feedback to learners and results have been documented that demonstrate feedback can increase student achievement (Bransford, Brown, and Cocking,

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1999). Feedback gives the learner the information necessary to revise and adjust their work. Online communication can help teachers provide this necessary component in instruction. Email and the electronic storage capability of conferencing software can help both students and teachers expedite the feedback process. Timely feedback in a non-threatening and constructive manner are crucial elements in the online teaching/learning process (Phipps and Merisotis, 2000). In fact, students who are at a distance "may have greater need for feedback than the traditional student" (ibid, p. 19).

It is important that the feedback process works in both directions. "If instructors are truly establishing a collaborative, transformative process, then formative as well a summative evaluation must be used" (Palloff and Pratt, 1999, p. 145). Online participation, journal reflections, self evaluations, and online surveys can provide valuable insight into the students' learning and provide instructors with valuable information. There are many assessment tools that can be used both formatively and summatively by online facilitators. These include online testing, electronic portfolios, journals, and collaborative assessment. Recently, online testing has been easier to administer with the advent of course management systems that allow instructors to establish time guidelines and grading rules. The parameters set by the instructors allow for the assessments to be graded electronically, provide feedback to the students, and interfaced with an electronic grade book (Palloff and Pratt, 1999).

Traditional assessments can be included easily in an online course but instructors also need to consider the higher weight that class participation plays in an online course (Palloff and Pratt, 1999). "One of the most effective ways to promote student participation in an online class is to make it required and graded" (Ko and Rossen, 2001, p. 222). Because of the limitations of the medium, one of the main forms of insight into student engagement and learning occurs through online contributions. Ko and Rossen (2001) recommend that online participation make up 10 to 50 percent of the course grade. Because of the highly interactive nature of the interactions used by the author of this paper, she has found success in the 40 to 50 percent range in her courses. An online rubric that evaluates both quality and quantity of contributions, timeliness, and significance of contribution to the overall discussion is a necessary component to evaluating the online dialog (ibid, 2001).

Peer, one-on-one mentoring, tutoring, and access to experts can also be easily used in an online format. The interactions that occur in these structures can provide timely and valuable feedback to the learner. Studies have demonstrated that peer feedback, mentoring, and tutoring can help in student's academic gains (Slavin, 1991). When these structures are incorporated into an online format, they can assist learners in helping them refine their thinking and their writing (Bransford, Brown, and Cocking, 1999). Archives of student work from current and previous classes create a wealth of valuable materials that can provide direction, insight, and feedback for students. The interactive nature of the electronic dialog and the digital format allows multiple passes to be made through the information. Activities that take advantage of multiple passes allow learners to reflect on their progress over the extent of the course. They also allow students to globally assess and evaluate the class discussion providing valuable insight to the learners and the instructor.

Conclusion

A preliminary report by the Institute for Higher Education Policy concluded that research is demonstrating that technology is not nearly as important on student learning and satisfaction "as other factors, such as learning tasks, learner characteristics, student motivation, and the instructor" (Phipps and Merisotis, 1999, p. 31). The use of technology in distance education may require that we not lose focus on learner-centered principles. These fourteen principles could provide the theoretical bridge to guide instructors in their efforts to creative effective teaching and learning environments online.

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Open Software for Internet Learning and Teaching

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Abstract: After some 3 years of experimentation with scripting languages, database- and web-servers, the Department of Computer Science and Information Systems (DCSIS) at the University of South Africa (Unisa), a long-distance institution, subscribes to the view that technology-supported instruction is more suitable to a step-by-step development process contingent to the elimination of a wide range of barriers that preclude proper teaching methodology in an on-line environment. This belief is in opposition to the many commercial software products available, and/or institutional demands that precipitate a hurried move to on-line teaching. This paper highlights issues and areas of development that may be of interest to those departments taking its first steps towards online teaching. In particular, it is shown how open source software provides power, functionality and freedom in developing a dynamic, low maintenance yet easily administrative web site by taking advantage of a centralized departmental workflow system. It is not intended as a technical discussion on teaching methodology, scripting languages and web-design issues - rather, as a case study, it attempts to coalesce the advantages of open source software with both the quality of the Internet experience for the student and the ease of administration thereof.

1. Introduction and background

Despite the proliferation of published research on On-line Learning in the last few years (e.g.Axelson, 1997; Barnard, 1997; Bates and Escamilla-de-los-Santos, 1997; Cyrs, Menges et al., 1997; Guernsey, 1998; Eisler, 2000; Soong, Chan, Chua & Loh, 2001), the application of results to facilitate the distance-learning process with the Internet as medium has not been as significant as one would have expected. Generally speaking, presentation is limited to static pages promoting a faculty and the courses it offers to a wider geographical reach, with little evidence of instructional interactivity other than instructor accessibility through web communication channels such as e-mail, chat- and news-groups. Those that do venture beyond static presentations and/or provide full Internet-based courses appears limited, with the majority offering supplementary information to in-campus courses in a homegrown juxtaposition of instructional and non-instructional web-based elements, normally integrated into a portal environment.

Many universities today embrace portal technology (UniPortals, 2001). While these portals are impressive gateways to organized and customized campus-wide information, their function, by definition, excludes active online-instruction pathways. Most academic institutions, it seems, are simply not ready to deliver online instruction, and as a result, the market for e-learning has been slow to take off (ST 2001). The reasons for this lack of readiness/preparedness may vary from institution to institution. Generally speaking, some of the more prominent constraints include, *inter alia:* substandard technology infrastructure delivery and support; low funding; failure to localize technologies in opposition to Western influences; low levels of lecturer/facilitator expertise and commitment coupled with a shortage of educational technology-, instructional design-, and learning development staff; low levels of student accessibility to the Internet; bandwidth availability and/or accessibility; and non-suitability of academic content and goals to such designs.

When online instruction is offered, it is perceptible that routes of least resistance are followed – and not without reason. Redesigning a traditional course for the Web requires, at minimum, a vast knowledge of learning theories, instructional implications and the tools available to effect realization of learning goals and objectives. Given the absence of educational technology-, instructional design-, and learning development staff and the expected low levels of lecturer

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expertise (and perhaps commitment) in this field, potential academic course designers are tempted to follow the route of least resistance and opt for one of the many commercial groupware products (e.g. WebCT, Lotus Notes) that is available from more than 250 firms (ST, 2001) eager to help universities go on-line. In a potentially vast market for electronically delivered teaching material, these products, by inheritance, are designed to ease and facilitate the transition from traditional to internet-based designs.

While these sophisticated products has much to offer, a comparison of 15 On-line Course Delivery Software products (i.e. commercial groupware) in terms of developmental features, instructor tools, instructional features, student tools, technical support, administrator tools/features and hardware requirements (Review, 2001) reveals a perplexing array of choices that is beyond the scope of this paper. Suffice to say that institutional implementation of such a tool (a necessity given the costs involved) *defines* a composite teaching and delivery process across an institution which may or may not correspond to the best current on-line learning model for a particular course. From a pedagogical perspective, there is a strong view that academic content and goals, rather than available technology, should determine course design. This is not to say that the higher-end products do not facilitate and ensure some level of effective instructional interactivity via the Internet, but despite the benefits associated with their use and some allowances for flexibility, the concern remains that here the presenter is shepherd by a technology that largely dictates his/her course design and delivery methods.

Furthermore, despite increases in bandwidth technologies and worldwide access, even basic Internet access is not readily available to all potential students. This constraint is sometimes referred to as the "last mile" problem (Kostopoulis, 1998). The principle of technological minimalism dictates that an institution/faculty/lecturer needs to consider the lowest level of technology to which each student has access to – and perhaps their level of computer literacy - when decisions are made about the minimum technological requirements needed to deliver, and have access to the course. From this perspective, it becomes clear, once again, that the means, ways and requirements to deliver course content via the Internet will not only differ from institution to institution, but also from course to course. As Berge (1999) then noted, "Ultimately, there is no need to apologise for espousing technological minimalism and the consequent well-designed use of the best features of low technology features".

In this nebulous environment, on-line learning efforts at UNISA are currently limited to interested departments/academe. UNISA has an "official" presence operated by its Computer Services department, with the Students-On-Line (SOL) facility their flagship application. A homegrown application, SOL provides to a student a personalized facility from where he/she has access to relevant administrative information, tutorial matter, and contact with lecturers and other students and electronic submission of assignments. The structure of SOL, however, does not completely fulfill the needs of DCSIS. More significantly, the freedom to structure and include facilities particular to DCSIS needs does not currently exist on SOL - much in the same way it does not exist in commercial tools. DCSIS has thus opted to do active research into this area, and after some 3 years of experimentation with scripting languages, database- and web-servers, the department currently subscribes to the view that technology-supported instruction is more suitable to a step-by-step development process contingent to the elimination of a wide range of barriers that preclude proper teaching methodology in an on-line environment.

2. A review of DCSIS's efforts

DCSIS has been engaged in a process of 'technology mastering", a term coined by Kostopolous (1998). The department has, amongst and in consultation with other departmental research projects related to online learning, explored and experimented with various scripting, database, Internet communication and operating software technologies as a tool for on-line learning in an effort to find the best solution, given its distinctive requirements. Research efforts will continue until such time that most conditions for successful Internet delivery are met, when a shift in focus towards instructional strategies, pedagogy and materials can be effected. In other words, DCSIS is of the opinion that to put education over the Internet into practice successfully, one need first effectively address the issues that are associated with the implementation of such an undertaking before concerning oneself with course design and presentation.

To the extent that most people believe complex interactivity will require not only complex programming but also a combination of distributed and central support, departmental resources and reallocated central resources, DCSIS's experience so far has been quite the opposite. The adoption of open source software (OSS) products as the focus of our experiments has been a liberating experience. The hallmark of OSS, off course, is that you can access a program's source files as opposed to most commercial software that is released as a binary file keeping the source file secret. One of the advantages of being able to access the source files is that you can then alter the program to make it do something different or something new. Another advantage of OSS that is sometimes overlooked is that there is tremendous support

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from a widely distributed and cooperative community with several source repositories, sites with tutorials and thriving mailing lists. The meteoric rise of OSS has arguably been one of the more significant developments in the evolution of information technology over the past decade. "Open source" today embraces the interoperability of a variety of software products based on de juro or de facto standards, with more and more end-users customers committing to an open source technology solution (Harmon, 1999). As a result, computer and system software vendors are dedicated to the development of open systems strategies and product lines. OSS allowed DCSIS not only greater freedom of choice in determining which hardware platforms, operating systems, applications and development environments are best suited to our particular need/s, but also greater freedom of innovation.

DCSIS finds itself in the unique position that its courses have as a requirement a Personal Computer or access to one. From access reports generated by our server, most students have access to the Internet, although it is not a stated requirement. Furthermore, DCSIS has 3 in-departmental servers allowing it to experiment in its own-defined environments. The current development environment uses a Linux platform that hosts an Apache[1] web server and a mail server, and uses a MySQL[2] database and a PHP[3] scripting engine for interactive and dynamic web page creation.

3. The design, layout and content of the DCSIS site.

Given DCSIS's experiences and understanding of the current status and feasibility of on-line learning and teaching, its efforts are currently focused on building a dynamically generated, low maintenance and easy to administer web site that: (a) Reveals a "distant" and "disguised" department and its "faceless" lecturers to students by providing a personalized experience; (b) Is dynamically generated by and administrated through ordinary daily work-flow activities. The aim is to provide lecturers with web-based administrative interfaces to be used in their daily non-web related activities. These interfaces serve the dual purpose of allowing the website to tap into the workflow model of the department, without increasing lecturer workload; (c) Speeds up the delivery process and communication pathways innate to distant education by providing students with quick access to course information, lecturers, module announcements, news groups, email facilities, downloadable material, frequently-asked-questions (FAQ's) and study links, and (d) Provides prospective students with inclusive course information to help them make informed choices;

To achieve these goals, the first step taken was the creation of a departmental database that fitted both the workflow model of the department and common and specific areas of course needs as it pertains to a web presence. Once the database and tables were defined and created, the next step was to develop web-based applications, to be used by lecturers in their daily non-web duties, to populate and administer the website. By tapping into the workflow model of the department, these applications also automate the management of the database. Skeleton pages generated default content in the absence of lecturer input and thus preserved the flow and content of the website. The departmental database, in combination with PHP, provides a powerful data repository system that effortlessly drives the entire content of the web site on a daily basis, as the next section illustrates.

4. Administration of the site

An infinite number of applications can be designed to ease administration of the database from which the web site is generated. Two examples of simple, yet powerful applications are presented to illustrate the marriage between web-based applications, the departmental database (where applicable), departmental workflow and web output.

Figure 2 shows a web-based administrative interface used for uploading, deleting and editing tutorial files on the departmental intranet server (for administrative and archival purposes not related to the web site) as well as the web server (for download by students).

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[1] The Apache Web server (http://www.apache.org) accounts for over sixty percent of Web servers on the Internet, and is an automatic choice given its modular nature and the support it receives from the OSS community.

[2] MySQL (http://www.tcx.se) is a very fast, multi-threaded, multi-user and robust SQL (Structured Query Language) database server. Its less restrictive license allows more rapid development, and it is particularly popular as back-end database to PHP scripts.

[3] PHP (http://www.php.net), an acronym for PHP Hypertext Preprocessor, is an open-source, platform-independent, server-side embedded general purpose scripting language allowing it to work within an HTML document to confer to it the capacity of generating content on demand. Its syntax draws upon C, Java, and Perl. The PHP-4 scripting engine is well optimized for the response times needed on web applications.

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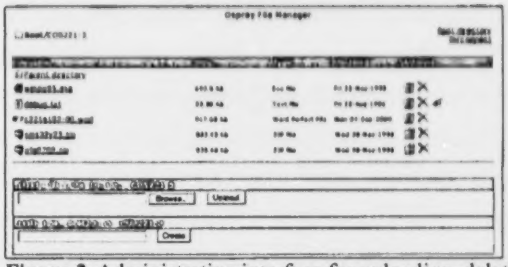

Figure 2. Administrative interface for uploading, deleting, and editing learning material.

Prior to the development of this application, the following actions took place: (1) a lecturer uploaded tutorial files to the intranet server, (2) emailed the departmental administrator and a web officer informing them of the upload, (3) the web officer uploaded the file to the web server, and (4) posted a note on the site informing students of the new material. When a mistake was made, the process had to be repeated.

Now, a single action of upload has combined all these actions into one event. In Figure 2, a lecturer has logged on to the web server under module directory COS221-3. Files currently available for download by students on the web are presented in a Windows Explorer environment, with options to delete, edit and rename files. When uploading a file, the following actions automatically take place in the background: (1) the file is uploaded to the departmental web server into the relevant directory; (2) the file is also uploaded to the departmental intranet server; (3) a message is posted on the web site informing the relevant students that new material in available; and (4) an email is sent to the administrator informing her that back-up material has been uploaded.

This application is a variant of an application freely available as OSS. It was adapted and upgraded to serve the department's purposes - specifically, steps 2 to 4 here above as well as icons and file type descriptions have been added to the source code, while the layout was also adapted. DCSIS is currently consulting with the university's Computer Services section to have access to the university student database. In an open systems environment, the application can be extended to a fifth step where a personalized e-mail is sent to each student registered for that course, informing them that new material is available for download. Off course, sending the file to the student as an attachment would prove ideal, but the load such an action would create on the mail server would not be justified. There are other inherent advantages to such an open systems environment - for example, access to areas of the DCSIS web site can be controlled by a generic login and password system using and without having to replicate the university database, the obvious administrative advantages in terms of database management, and the centralization of information by integration of a departmental applications with the university database.

The second example refers to an on-line registration application. Students can currently enroll for certain certificate courses presented by the department via the Internet, the process being fully automatic as follows: a student completes the on-line registration form and sends it off to the departmental database. An e-mail containing the necessary information is generated informing the lecturer that a registration has occurred. If accepted, the lecturer clicks a button imbedded in his/her e-mail notice that not only generates a response e-mail informing the student of his acceptance, but also creates personal server space (pigeon holes) for the student to electronically submit assignments. Lecturers are notified per mail when assignments arrive in these personal spaces. Students can also change personal details such as password, postal address and contact telephone numbers via the web. This process serves to illustrate the power of a scripting language and database server in creating mini web-based applications *tailored* to the individual needs and preferences of a lecturer/course.

Other applications currently used in the department and specific to the website include administrative interfaces to manage personal information, a module homepage, a module's FAQ section, route email to different lecturers, PHPMyAdmin (a web-based interface for administering the database), and a web-based clocking system that interacts with the website showing which lecturers are available, i.e. "In" or "Out" should a student (or colleague) wish to contact him/her. A threaded discussion/newsgroup application incorporates the ability to manage groups per course as well as allowing the upload of assignments.

Figure 3 shows a personalized and customized page for a hypothetical student taking 3 modules, with content generated from the database for three modules.

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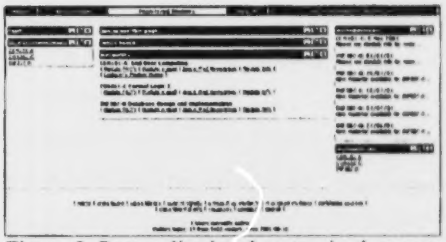

Figure 3. Personalized and customized page generated by PHP from the departmental MySQL database.

Any panel can be minimized, maximized or closed depending on the preferences of the student. In the example three panels have been minimized. All the content and hyperlinks that appear on this page and subsequent pages are dynamically generated from the database. For example, an extra hyperlink (Lecturer's Module Home) appears under CEM101-A in the myCourses panel. This link is generated based on the fact that a certain page with a predefined title exists in a predefined directory. If the page does not exist, the link is not generated. Should the title of the course CEM101-A, change, all references to the title, across the site, is automatically updated the moment the new title is updated in the database. Similarly, when a new lecturer takes responsibility for the module, or when a new course is added to the database, the code in the home and its linked pages will automatically generate the necessary content and hyperlinks.

As noted earlier, the content that appears is independent from lecturer input via the "skeleton" approach. In the absence of a formal departmental policy this approach allows those lecturers that want to experiment further with on-line teaching the space to do so, without detracting from those modules where lecturers are not ready or have the time to experiment. Thus, depending on what information is available in the database (and in the directory structure on the server in some instances), the module homepage either has lecturer-driven content or the page is presented with skeleton content providing basic but useful information.

While this automation would not be possible without a well-designed database, it is the power, functionality and freedom of PHP as a scripting language that provides the backbone of the current site. These characteristics of PHP, it is felt, can easily be extended to include interactive features related to online learning.

5. Interactive features

According to transactional distance theory (Moore, 1993), there are three key constituent elements of distance education: dialogue, structure, and learner autonomy. "Dialogue" refers to the extent to which teachers and learners can interact with each other, and "structure" refers to the "responsiveness" of an educational program to learners. Learner autonomy is the extent to which learners make "decisions regarding their own learning" and "construct their own knowledge based on their own experience" (Moore and Kearsley, 1996).

In keeping with DCSIS's policy of technology mastering, the site's interactive features are currently limited to "Dialogue", and perhaps to a lesser extent, "Learner Autonomy". In terms of dialogue, the mo st useful current feature of the site as a "learning environment" is that students can interact with fellow students, with lecturers and with on-line content/resources through a module homepage and discussion groups that attempts to personalize the faceless interaction typical of distance learning environments. When a student personalizes the site to reflect his/her current courses, the interaction not only becomes more personal, but also provides a single interface from where he/she has access to all information/interaction that is currently offered from the site. Bates (1995) called such interaction "the most powerful of all technologies available".

Asynchronous communication via web-based discussion groups (spawned into e-mail newsgroups) and lecturer e-mail allows for time-independent interaction and has many inherited benefits. For example, a lecturer can, after following a threaded debate on a newsgroup about a particular problem, redirect its course or post an answer to his discussion group, the latter being automatically stored (if lecturer wants to) in the database from where a module FAQ-list with answers is generated. This collaborative learning environment stresses active participation and interaction on the part of both the learners and instructors, while it engages students in higher level thinking skills. The capacity thus exists to support both formal (instructor driven) and informal (student driven) environments. Interestingly, experience has shown

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that many students access the Internet from their workplace where firewalls may prevent connection to news servers. This makes the use of both web- and e-mail-based newsgroups a necessity.

"Learner Autonomy" is perhaps inherent in the site in that it provides archival on-line and multiperspective resources facilities that are introduced via general and module-specific download areas,. WWW-links to authentic (real-world) learning environments are also provided where multiperspective views on subject matter are offered.

All four of Poulsen's (1995) pedagogical techniques for computer-mediated communication, i.e. one-alone, one-to-one, one-to-many and many-to-many, are thus inherent in the current site.

Given that DCSIS offer long-distance courses, these types of interaction, while perhaps limited, has proved most productive and invaluable to our students as it creates a virtual community with a sense of belonging and sharing. Students also know that their efforts and interaction is viewed and evaluated by the lecturer concerned, and this nurtures the senses of belonging, personalization and interaction. Here, the impact on student learning is far outweighs the time, effort and resources it required to create the environment.

6. Summary

Given several constraints, DCSIS is convinced that technology-supported instruction is more suitable to a step-by-step development process. In particular, such an approach allows the time and space in which to create simple yet powerful web-based applications that taps into, and sometimes improves, the departmental workflow.

The current development platform of PHP, MySQL and Apache has demonstrated its usefulness in building a dynamic home site that is easily administrable, yet powerful and scalable enough to allow for the future inclusion of complex interactions and even new technologies. When higher levels of interaction become attainable, the development platform is expected to fulfill whatever needs and requirements exist at that time, be it in the provision of applications to support interactive learning, or in the delivery process.

With these efforts, DCSIS is confident that the on-line technology for learning will remain in the hands of educators, ensuring capacity to act against business's attempts to hi-jack higher education.

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EZ-Learning

EZ-Learning is a learning environment based on speech technology and all means of multimedia, in other words an educational authoring system.

The system is fully independent of language and contents. This means that all messages and orders appearing on the screen can be found in files and that they can be changed without modifying a single letter of the program code. The program flow is fully determined by the method on the one hand and by the results obtained on the other hand. This also means that the contents of the system can be changed without modifications of the software.

At the start the student is asked to take an initial test. This test determines his level. The system will then suggest where the student should start the course.

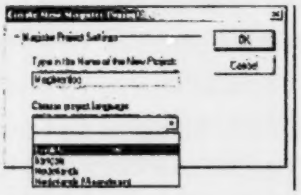
After the start the automatic evaluation system will be activated: the computer will then guide the student through the course.

There are various forms available for the presentation of theory: text with or without speech, text with (video)animation.

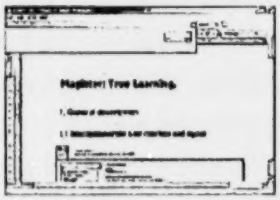
Quick Developer

Concepts

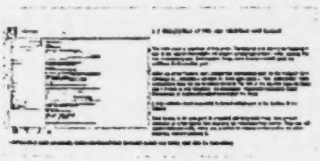
Magister turns a MS-Word document into a Magister Computer based training. After starting QD the user is asked to start a new project and to choose a language:



The project name is the name of the directory where your document is saved. QD will open the document and save all the information in the Magister databases and will save the graphic files in the right directory.



QD has now created a Magister True Learning Training. Texts are converted into lessons and are using the graphic files of the document. The texts are highlighted while they are spoken.



Exercises are created:

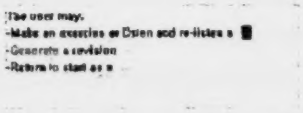
About 15 practise forms are provided: blanks exercises with or without clue, blanks exercises with speech, dictation, word order, picture matching, vocabulary, crossword puzzles, etc.

The student can generate his own revision exercises and test his knowledge over larger areas.

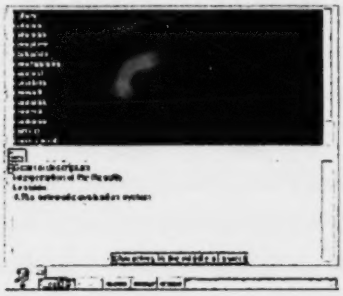
Furthermore there is an advanced search system available to allow the student to look up words. A dictionary is available, provided with the same search mechanism. This dictionary can also be used as a monolingual dictionary.

The learning environment has 3 important parts:

- Quick Developer: to convert an existing course from word into a computer based training
- Developer: to create and to maintain courses
- Magister: the system to run a course, to correct courses, to keep results, etc.



Texts are saved into help files. This is very helpful for the user, because he can use the extensive Magister search system.



The Document

The conversion of a document needs some characteristics of the document:

- The name of the document is used as the name of the course
- Heading 1 lines are converted into units
- Heading 2 lines are converted into lessons
- Heading 3 lines are converted into page breaks of a lesson
- The headings have to follow the natural order, it is impossible to have heading 1 followed by heading 3.

Magister generates 3 kinds of exercises:

1) Drag and drop
2) Gap filling
3) Gap Text

QD searches for words which are marked as bold or underlined or words proceeded by a special character, and generate exercises based on the following rules:

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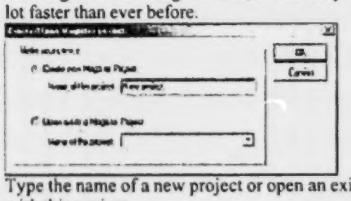
- Paragraphs containing sentences with 1 marked word are converted type 1. E.g.: First you are asked to do an initial test, which is based on the first unit, its lessons and exercises.
- Paragraphs containing sentences with more than 1 marked word are converted type 3. E.g.: First you are asked to do an initial test, which is based on the first unit, its lessons and exercises.
- Paragraphs containing sentences with marked words at the end of the sentence are converted type 2. E.g.: First you are asked to do an initial test, which is based on the first unit, its lessons and exercises.

Developer

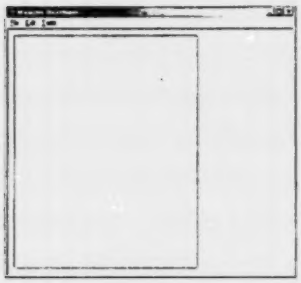
Concepts

Start

Developer (MD) is a tool to develop the contents of a Magister Training Course. Using this tool, the development of contents will be a lot faster than ever before.



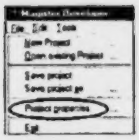
Type the name of a new project or open an existing project to continue with this project.
When starting a new project the next screen will appear.



Properties of a project

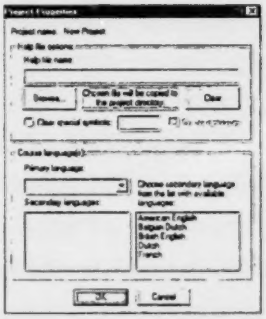
After you have determined a project or opened an existing project, the following (empty) screen appears.

Click on 'file' and choose 'Project Properties' to make a few choices.

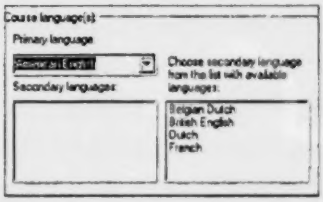


Now you can determine a number of properties of the project: you can use a file that you want to use as help, you choose a basic language for the training.

The choice of languages is limited to the languages that are supported by Real Speak™. This choice also determines the languages that will be given on CD-ROM.



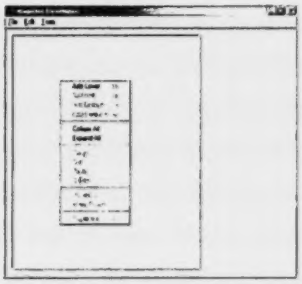
You can choose one or more additional languages. After you chose your basic language, you will see this language disappear in the list of additional languages.



It is possible to adapt these properties later.

Building a content tree

Now you can start building the content tree. Double click the right mouse button in the empty field.



Start with adding a level, even if you only plan 1 level in the course, it is necessary to start a level. Magister does not let you continue without a level.

Now you can add units, lessons and exercises.

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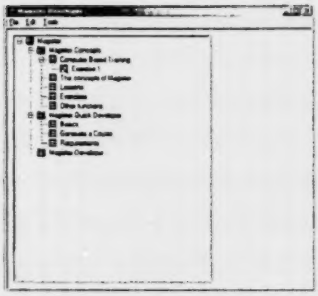
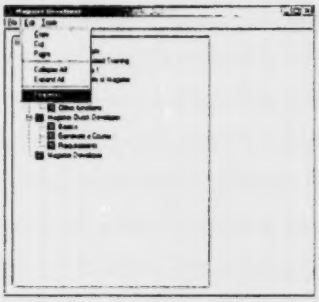
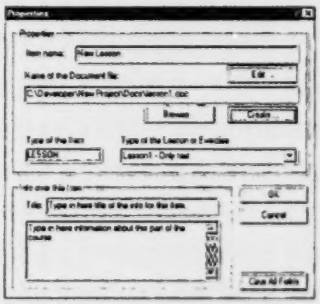


Double click on one of the entries to see the properties of this entry, or click on "edit" and choose properties.



Properties



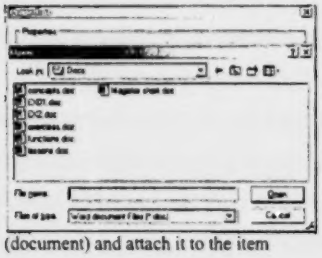
The window 'Properties' is showing

- Item Name: The chosen name of the item
- Name of the Document file: the name of the document on the hard disk, together with its path
- Type of the item: a level, a unit, a lesson or an exercise
- Type of the lesson or exercise: here you choose the type of exercise or type of lesson
- Title: choose a title and add information (if necessary)

The window shows a few buttons:

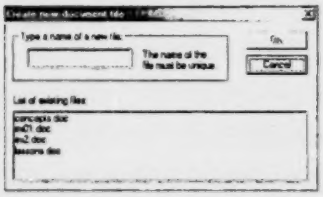
- Edit: this button can be used to edit an existing document; this button may only be used if a file has been created. If no file has been created or attached, the button will not be accessible.

- Browse: this button is used to search an existing file

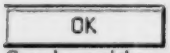


(document) and attach it to the item

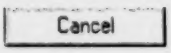
- Create: type the name of a file; this name must be unique. That's why a window will be shown with a list of all existing documents.



- OK: this button will attach the information to the item

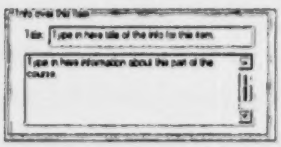


- Cancel: cancel the operation and return to the previous screen



- Clear All Fields: click on this button to clear all the fields in this window at once

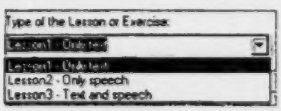
There is still one important field in this window: Info about this item.



This text is important and will be used to give more information about lessons and exercises in the CBT.

Lessons

Choice



There are 3 types of lessons, which can be chosen in the properties of the lesson.

- Only text: texts are shown, not read

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- Only speech: texts are only read and won't be shown on the screen
- Text and speech: texts are shown on the screen and read. The text is highlighted while it is read.

In the third case, it is also possible to have one language for the written text and another language for the spoken text.

If your text contains very large pictures, it is advisable to choose lesson type 2, because your picture will cover almost the whole screen and it will be difficult to see the text (if shown).

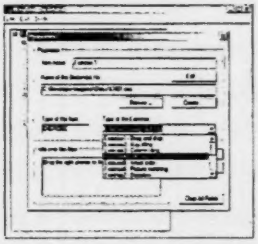
You may now start to build the lessons. Lessons are texts where you may add a movie (mpeg or avi) or graphic files (pictures, photographs).

All your texts will be made in MS-Word and you don't need to learn anything new. Type your lessons as you used to do, insert graphic files or movies, Developer will convert these texts at the time that you want to generate the course.

Exercises

Choice

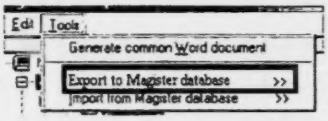
Exercises are made in a similar way as lessons. Double click on the name of the exercise to see its properties and choose the type of exercise you want to make. The different types of exercises are explained in the part 'Magister'



Once you have defined the properties of an exercises (name, information, type), a document will be named and you can start typing you exercise in MS-Word. In some types you only need to type texts, some require that you indicate the solution by making word(s) bold. Other types of exercises require that you make a table with solutions in bold face.
The bottom line is: this is easy for the creator of a course. You don't have to learn a lot, you can work with in a familiar environment.

Computer Based Training

If you decide that your CBT is final now or ready to test, you may now generate the training. Click on the Tools and choose "Export to Magister database"



The main screen consists of **five** parts. The largest and also most important part is t he one in the middle. All proper actions take place in this screen. The **four** remaining parts (Information, Help, Main buttons and Report) are additions to this active part.

At the top of the screen you can see the **information** part. In this strip a short message or instruction appears for each new screen. This text clarifies what is expected from the user at that moment. The logo of Educa and a button to exit Magister are displayed far left at the top. Whenever you want extra information or an explanation you can consult "Help".

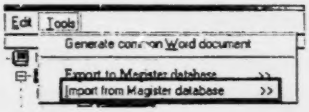
A strip with the most important buttons is displayed at the bottom of the screen.
Each button in the program is supplied with a specific help line: a short sentence or a few words that describe the function of the button. This

Once exported to the databases, you can start using the CBT, but first you have to attach the databases to Magister with the Magister Setup Program.

Modify a CBT

During the creation process of a CBT, Developer creates a number of files (Doc files). After you have generated, these files may be obsolete and maybe you decide to remove these files.

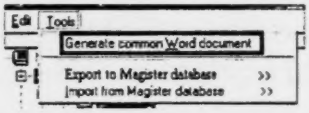
What do you need to do if you removed files too quickly and need to use these files again? Developer has the solution.



Go to tools and use the function 'Import from Magister database'. MD imports the databases and creates a project and puts all the data into the necessary files. Now, you can modify the whole CBT again.

CBT Document

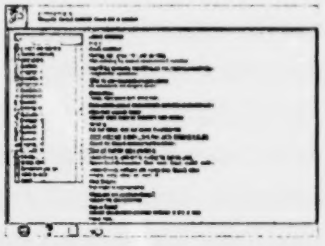
Developer offers the possibility to turn your CBT into a Word document.



MD generates a Word document that can be given to the student in an electronic or paper format.

The Magister Engine and Databases

Description of the user interface and layout



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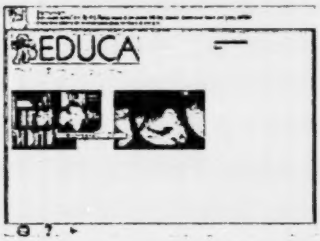
text will appear automatically when you position the cursor on the button for a few seconds, without clicking it.

The two other parts are usually hidden: on the left side the report screen and on the right sides the help screen.

Working with Magister

A starting screen appears to select the content of your choice. There are 3 options on this screen:



1) A photo or graphic to describe the content.
2) A list of registered users.
3) 3 buttons: to wipe a user, to start as a guest or to start as a user.

Starting as a guest

Before starting Magister as a guest a warning will be issued, notifying that the results will not be saved. The whole training can now be done without any restriction.

The user may:

-Make an exercise or listen and re-listen to a text
-Generate a revision test
-Return to start as a user

Starting

a) As a user

When you start the program, you first have to give a user name or choose one from the list. The results that you obtain on exercises and tests will be stored automatically under this name. You will function under this specific name until you exit the program or until you choose another name.

b) The first time

First, you are asked to take an initial test, which is based on the first unit (its lessons and exercises). If you achieve a sufficient result, you will be exempted from this unit. If your result is insufficient, this unit will be taken as active unit for the automatic evaluation. This procedure will be carried out only when you use the program for the first time. The procedure will be skipped in case you are not a new student/user.

c) Normal mode

A user can work in two different modes: revision mode or automatic evaluation mode. A user may switch modes between exercises, texts or tests.

Revision

You can get an overview of all done and exempted exercises, texts and tests. For each part it is indicated how well you have done. If you choose to repeat (one of) these parts, the former results will be replaced automatically by the new scores, which will be imported immediately to the automatic evaluation. You can also compose revision tests yourself on the basis of the exercises you have made so far.

Automatic Evaluation

The automatic evaluation is responsible for the automatic selection of exercises and depends on the obtained results of the exercises that you have done so far. Whenever moving to a next level the automatic evaluation is presented. It shows the result and interpretation of the previous exercise, and gives the possibility to repeat that exercise, in the event of doubt, or to go to the next one.

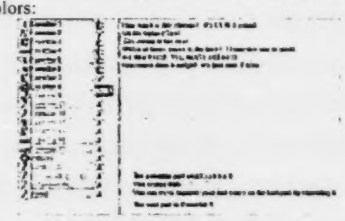
This screen also provides a graphical representation of the course's content. Here the position of the last and the next exercise in the course's hierarchy is clearly indicated with arrows.

As long as you are in the automatic evaluation, an extended recovery system is activated. This means that if you have left Magister while working in the automatic evaluation, you will return to exactly the same spot when you present yourself again.

Interpretation of the Results

Results

Scores on exercises and tests are presented and interpreted in the same way. The obtained percentages correspond to specific symbols and colors:



- No percentage: not done yet, gray
- Percentage is more than 80 in initial test: exempted, light blue
- Percentage is less than 60 not good, Red
- Percentage equals 60 or is less than 80: average score, Purple
- Percentage greater than 80: excellent, blue

Parts that are used at that moment by the automatic evaluation are presented in green.

Lessons

Overview of the lessons

A more detailed explanation about the course and lessons will be given in this part:

The "Info" (information) texts in the info part of Magister.
The help part of Magister which is a part of the content.
All pieces of text used in Magister: help text, text used in the automatic evaluation, texts used in the test wizard, i.e. all the words used by the program itself.

Lesson System

The course is based on a hierarchical structure:
Levels
Units
Lessons
Exercises...

Each level consists of a number of units and each unit contains a number of lessons. Each lesson incorporates theory, exercises and tests.

When moving to a next lesson, unit or level the automatic evaluation will decide whether you may continue or whether you have to repeat the previous part(s).

You can get an overview of all done and exempted exercises, texts and tests. For each part it is indicated how well you have done. If you choose to repeat (one of) these parts, the former results will be replaced automatically by the new scores, which will be imported immediately to the automatic evaluation. You can also compose revision tests yourself on the basis of the exercises you have made so far.

Different Types of Exercises

Magister offers a wide range of types of exercises. It depends on the course which types are being used. Each type of exercise is explained sufficiently in the information screen at the top.

- Available types of exercises:
- Drag and Drop: select the correct answer for each question.
- Gap Filling: fill in the correct word.
- Column Filling: complete the columns.
- Alternatives: select the correct answer from two or more alternatives.
- Word Order: form correct sentences by placing all sentence parts or words in the correct order.
- Picture Matching: connect each picture to the correct text.
- Dictation: listen and type the sentences. You can see these sentences on screen first.
- Question and Answer with Text To Speech: listen to the question and indicate the correct answer.
- Flash: listen to the words and watch them carefully; then say them yourself.
- Reading: read the displayed text out loud.
- Oral Gap Filling: complete the sentences by saying the correct answer.
- Gap Text: complete the sentences by filling in the missing words.
- Blind Dictation: listen carefully and type the pronounced sentences.
- Multiple Choice: click the correct answer for each question or sentence.
- True or false: indicate whether the statement is true or false.

Help

These are all the texts, which may be found in the right side screen of Magister. This help text is divided in pages and all the pages are related as hypertext pages, which mean that there is in fact no starting and no final page, but you will find a number of keys (or keywords), which make pages different.

In most parts of Magister you will find a button to activate this help function. Therefore, it is necessary to have a reference available on that page.

Dictionary

If it is useful in the training program, a dictionary may be added in the Help environment.

Each word in the dictionary may have a reference to the unit used in that level. This dictionary can always be used, except when making exercises or tests on the dictionary. Apart from the test wizard, you may generate special exercises on the dictionary. The result of these exercises will be saved as well.

The automatic evaluation system

The initial test

Start initial test

In order to decide which unit you can start with, you will first get a test on the first unit. If the score on this test is insufficient, you will start with this unit. If the result is sufficient, you will get the test of the next unit. If the result on this second test is unsatisfactory, you will start with this unit, otherwise you will move to the test of the third unit and so on...

The scores on these tests can lead to the following conclusions:

You obtained 80% or more: you are exempted from this unit and you will get the test of the next one.
You obtained less than 60%: the tested unit will be the first one in the automatic evaluation. The initial test is stopped and the normal learning system is started.
You obtained between 60% and 80%: you can choose to stop the initial test and start the learning system or to redo the previous unit. If you wish to repeat the unit and you have a score of 80% or more, the initial test will continue with the next unit. In all other cases the tested unit will be the first one in the automatic learning system.

If you are also exempted from the last exercise of the chosen level, you will immediately move to the automatic evaluation. In that case you can take a final test or you can select the next level.
If you exit Magister during an initial test, you will return to exactly the same position in the initial test when you present yourself again.

Evaluation between two parts

The automatic evaluat ion always happens between two main parts. The first part is the one that you have just finished and the second part is the one that the evaluation assigns to the user as the next one. If the score on the last exercise is less than 80%, you will have the possibility to remake this exercise.

Next part

Usually the next part of the lessons corresponds to the next part of the automatic evaluation. When the end of a level is reached, the total score of this part is calculated. This score is an average, determined for 40% by the exercises in the lesson/unit/level division and subdivisions (units/lessons) and for 60% by the test of the level (for this average, the tests of units are not taken into account).

If the average is less than 60%, you will automatically return to the first part of the lesson / unit / level division. If the average score is more than 60%, you will start the first part of the next level. If the automatic evaluation repeats a level, all parts with a score of more than 80% will be skipped. This also goes for the subdivision (units/lessons): if you obtain an average of (more than) 80% for a particular unit, the exercises of this unit will not be repeated.

End of a level

Levels are evaluated in the same way as units and lessons. You can only go to the next level if you obtain 80% or more. If your score is less than 60%, the evaluation remains within the same level and all exercises (of units and lessons) with a result of less than 80% will be repeated. If the average score of a level is between 60% and 80%, the choice is yours: you go to the next level or you repeat the exercises with a score of less than 80%.

Magister Setup

Before you can start working with your Magister Training, the course with its databases has to be attached to Magister. To open Magister Setup, click on Magister setup in the start menu:

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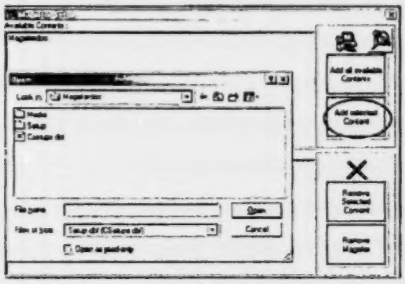
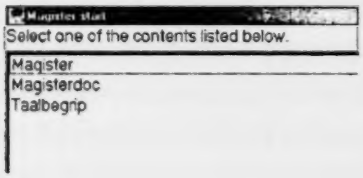
Search for the file "csetups" in the directory of the CBT that you have chosen.



Click on the name of the content first, and then click on the button "Add selected Content". The Magister Setup application will add the content to Magister. Now you can start Magister and choose the content of your choice.



Writing the Web: Linking Computer Technology and Writing Courses

Thomas Van Gilder, Appalachian State University, United States ; Derek Stanovsky, Appalachian State University, United States

Web page authoring poses a double challenge as both a technical and a writing task. During the Fall 2000 semester, Watauga College offered two linked courses aimed at providing first-year students with both the technical and editorial know-how to write for online audiences. Tom Van Gilder, computer consultant for the College of Arts and Sciences, taught "Exploration of a Wired World," a hands-on course designed to give the students the technical background they need to create content for the World Wide Web. These same students also enrolled in Derek Stanovsky's sections of Watauga College's "Tools of Human Understanding," an interdisciplinary writing course required of all entering Watauga students. These sections, entitled "Future Histories: Reading, Writing, and Remembering After the Internet," dealt with the intersections of technology, writing, and culture and asked students to produce writing specifically for this new medium.

Simplifying Maintenance of Web Pull-down Menus Through A Dynamic Menu Builder Approach

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Abstract: This paper presents an approach, which will simplify maintenance of pull-down web menus that are used in many web applications. A menu builder tool that dynamically generates the necessary javascript code allows non-technical users to easily modify a website's pull-down menu structure. The menu builder tool is a Visual Basic application that utilizes a simple database to track the details of the tree-like menu structure such as menu item caption, display characteristics, and associated web page link. A common need with web applications is to periodically modify the menu structure. For example, each year a conference website needs to add an item for the next year's conference. Since other tools allow non-technical users to easily create web pages, this approach makes it possible for these users to maintain their own pull-down menu websites without programming.

Introduction

A common situation is one where someone with technical web skills develops a web site for an organization or individual that does not have the technical skill to do the development themselves. The expectation is that, in the future, the site owner will be able to create new pages for the site through non-technical, easy to use tools like FrontPage that don't involve programming. A problem with this approach can occur when the web pages use a pull down menu structure, which will need to be modified periodically, since the site owner will have difficulty with the javascript programming needed. Finding someone to do maintenance on these types of web sites can be quite a challenge.

This paper presents an approach that will greatly simplify the maintenance of pull-down web menus through the use of a dynamic Menu Builder tool, which generates the necessary javascript code. The Menu Builder tool was developed as part of a master's student's final project, which added enhancements to the web site for a conference, named ICFC, hosted by an economics professor at our university.

Tool Description

The Menu Builder tool is a Visual Basic application that presents the user with an easy to use, GUI interface as shown in Figure 1 below. The main form has two tabs, **Build** to specify the menu structure and **Preview** to view the updated menu structure. The current pull-down menu structure is displayed in the left window using a tree view. The menu structure consists of a top menu group (**Home, ICFC 2001, Previous ICFC**) which will be displayed on web pages with a horizontal menu bar, submenus like **ICFC 2001** which are cascading menus activated by moving the mouse over the submenu name, and regular low level menu items like **Call for Paper** which can be clicked to follow a hyperlink to another web page.

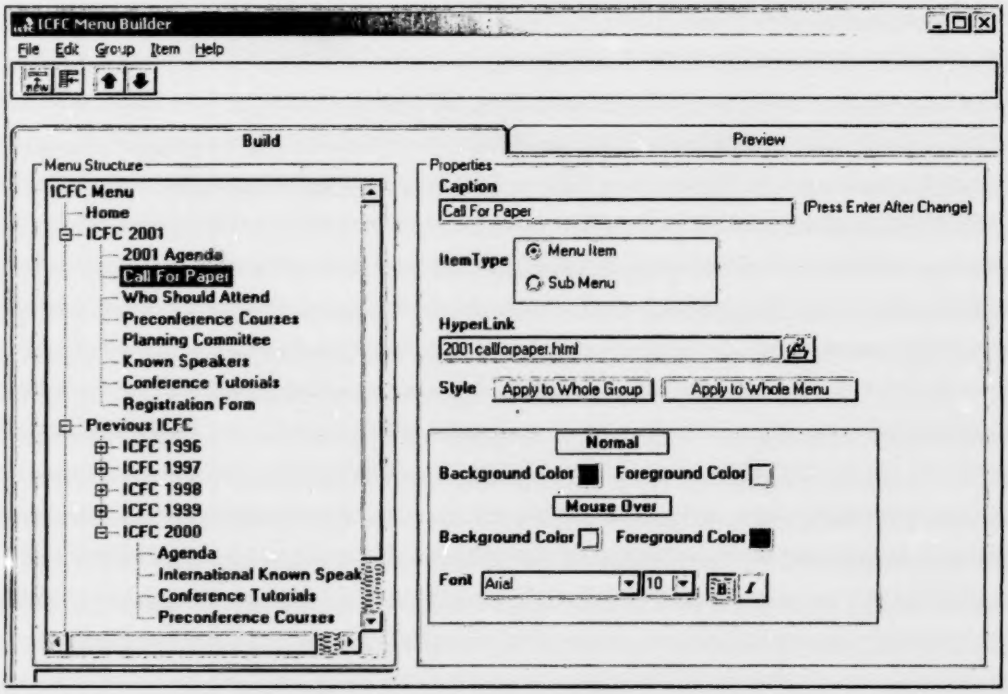

Figure 1: Menu Builder tool.

The properties of the selected menu item are also displayed and can be modified. These properties include the menu item's caption, type, hyperlink for low level menu items, background and foreground colors, and display specifications like font, size, and appearance. The details of the menu structure are stored in a simple Access database.

A portion of the ICFC Conference home page containing this menu structure is displayed in Figure 2 and shows the cascading menus.

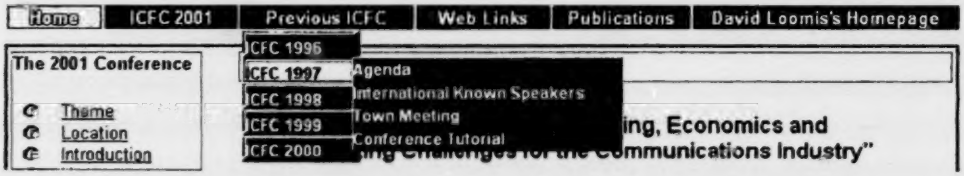

Figure 2: Example web page with generated menu.

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Basic Functionality

The functionality provided by the Menu Builder tool allows the user to easily and quickly build or modify the menu structure. The interface provides all the standard windows GUI features you would typically expect such as each option being listed under the tool's menus and also available with a right mouse click on the object. When you need to specify a hyperlink or file name, you can choose it from a list of the available objects of that type on the local computer rather than type in the name, which is prone to error.

The user can add an item to the menu structure either as a child or a sibling of the current selection. Items can also be changed, deleted, or moved up or down within a menu group. The user can even drag and drop menu items to modify the menu structure. Menu item properties need to be specified for each new menu item and can be changed for existing menu items. Changes to a menu item's properties such as font and background color can be applied to the whole menu structure, to a whole group, or to a single menu item.

When the user has finished specifying the menu structure, the **Generate Menu** option writes out the necessary files to incorporate the menu structure into web pages. The user specifies parameters that indicate the path where the generated files should be stored, information on the width of the menu, and positioning of the menu sub-items. Three files are created. The style.css file contains information on the menu style. Two javascript files contain the necessary code. The file topmenu.js contains the code for the horizontal emnu bar and the file menu.js contains code for the submenus.

The **Preview Menu** tab allows the user to see what an updated menu structure will look like so it is easy for the user to experiment with the content and look and feel of the menu structure. This option uses a shell of a web page and can only visualize the menu structure portion of the web page, not the contents of the web page itself.

Incorporating Generated Menus Into An Application

Figure 3 illustrates the integration of the menu builder program with the web pages utilizing the generated menu structure.

The menu builder tool is a stand-alone application running on the conference chair's desktop computer. MenuDB is a Microsoft Access database used to store the current structure of the menu. The Menu files are generated and then copied to the server where the web page files (HTML, ASP) reside. This tool generates javascript code using DIV tags which are supported by both Internet Explorer 4.0 and Netscape 4.0.

Each time you generate the menu structure or add web pages to the web site, you need to do something so that the correct menu will be displayed. For example, you need to include the menu on each new web page that will also use the menu structure by following the directions shown in Figure 4.

The MenuDB database consists of a single table that stores the detailed information on each menu item (type, caption, background and foreground colors, font, hyperlink, mouse over colors) and two columns, key and parent, that record the menu structure hierarchy. Each menu item is identified by a key, which is automatically assigned as items are added to the menu structure. The parent column indicates each item's parent menu item, detailing the tree hierarchy that forms the menu structure. The user will not ever be aware of the key and parent columns. The menu item type indicates whether the item is part of the top menu group, a submenu item, or a lowest level menu item. Only the low level menu items will have links to other web pages

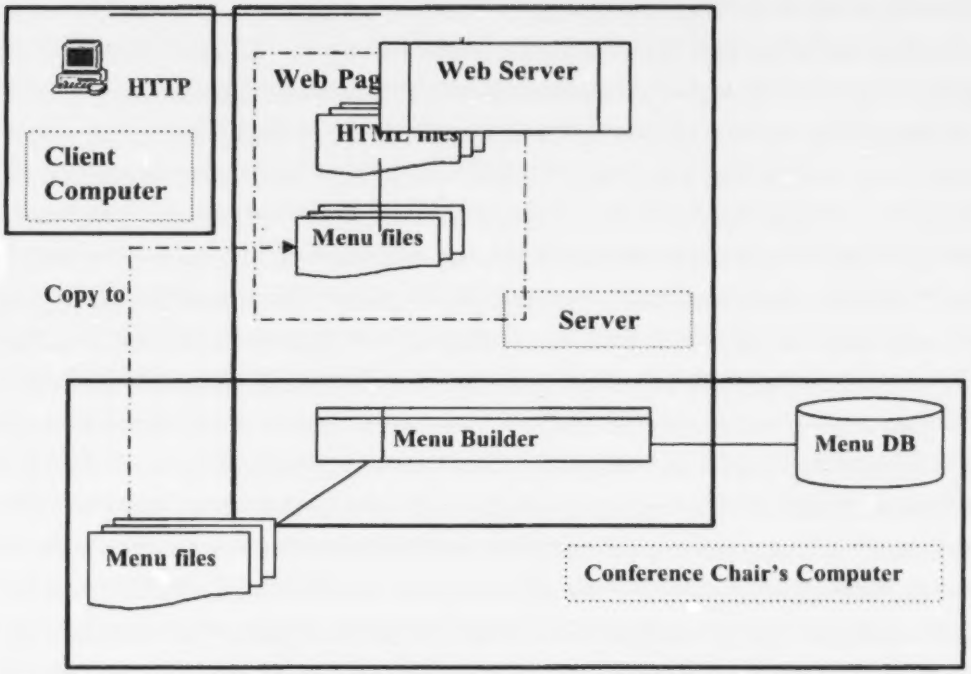

Figure 3: Architecture of web application with Menu builder tool.

```
# MODIFY THE HTML CODE FOR THE WEB PAGES CONTAINING THE MENU AS FOLLOWS:

PLACE THE FOLLOWING CODE BETWEEN <HEAD> AND </HEAD> TAG
<link rel=stylesheet href="style.css" type="text/css" >

PLACE THE FOLLOWING CODE RIGHT AFTER THE <BODY> TAG
<script language="JavaScript" src='menu.js'></script>
<script language="JavaScript" src='topmenu.js'></script>
```

Figure 4: Directions for incorporating generated menu into web page.

Conclusions

Using this menu builder tool, maintenance will be minimized whether done by a technical or non-technical user, so changes to the menu structure of a web site can be done very quickly. In addition the menu builder approach guarantees the integrity of the menu code so extensive testing will not be needed each time the menu structure is modified.

A menu builder tool like the one described in this paper that dynamically generates the necessary javascript code allows non-technical users to easily modify a website's pull-down menu structure. Since other tools allow non-technical users to easily create web pages, this approach makes it possible for these users to maintain their own pull-down menu websites without programming.

A Workbench for Investigating an Alternative Reading Technique: Rapid Serial Visual Presentation

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Abstract: Previous research carried out in the field of reading offers insights into the cognitive processes involved in reading and recommends new reading techniques like Rapid Serial Visual Presentation (RSVP). RSVP displays text on the screen one word at a time. Essentially, RSVP brings the words to the reader's eyes instead of his/her eyes going to the words. In order to assess the impact of the RSVP reading technique on reading speed and comprehension, a workbench called Monolithic Reading Browser (MRB) was developed. The workbench not only implements the RSVP reading technique but also has components for tracking and collecting information from subjects. This paper describes the MRB workbench that will aid researchers in investigating the effectiveness of the RSVP reading technique. Thus, future research using this workbench will shed some light on the effectiveness of the RSVP reading technique that may allow users to better traverse the vast information space available in the World Wide Web.

Introduction

Currently there is a vast amount of information available on the World Wide Web (WWW). People are turning more frequently to this source of information rather than using traditional library resources. At this time, people who retrieve information from the web use conventional software applications like the ubiquitous web browsers or Acrobat Reader to display web content. The basic function of these applications is to display web pages as created by the site designer. This very fact restricts the users from customizing the web page presentation. This restriction poses many problems in the users' ability to read information. The users have very little control over how the information being read is presented. Bad presentation patterns, poor color combinations and illegible fonts prove to be a hindrance in reading and understanding the text.

Most information sources (e.g. different web sites) have different presentation styles. The users are forced to adjust to the various visual aspects of the text at different sites. Various foreground and background colors, font sizes, and font types create a number of problems like illegibility, inaccuracy of reading, and disinterest on the part of the readers (Taylor and Taylor, 1983). These factors may have an impact on the reading speed and comprehension of the readers.

While browsers and other conventional reading tools provide the capability for changing some attributes such as fonts and display resolution, the user does not have complete control over all visual attributes of the document. Poor website design coupled with the inability to personalize the interface can result in screen illegibility and disinterest on part of the users. As a consequence, reading speeds and comprehension may be affected.

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Allowing for personalization will permit the user to control the presentation of reading material and thus may have a positive impact on reading speed and comprehension.

Research about brain and eye functioning while reading provides us with insights that could be used to address the problems mentioned above. Previous research in the field of reading psychology suggests that reading is a brain function that is carried out by the eyes in a specific manner. One reads, not by sweeping one's eyes along a line of print, but by moving one's viewpoint in a series of little jumps, called saccades. In order to see, a reader focuses the image of an object on the retina. Various tests have revealed that the reader's visual acuity is sharpest in the center of the visual field, which is called the fovea. Vision is clearest in this region, and its clarity lessens with the decrease in density of the receptor cells as one moves away from the fovea.

Insup Taylor from University of Toronto and M. Martin Taylor from Defense and Civil Institute of Environmental Medicine, Ontario, have conducted research in the field of reading psychology that suggests that if the eye movements are bypassed, people seem to read faster. Bypassing the eye movements does not impair comprehension since the fovea is the most receptive area of the eye. Thus, in their opinion, if words from a text are displayed in the center of a display area, one word at a time, the individual will save the time required for moving the eye from one word to another. Consequently, a reader will increase his or her reading speed and comprehension since the reader will only use the foveal region to comprehend the meaning of that single word at a given instant. This technique of reading text one word at a time has been referred to as Rapid Serial Visual Presentation (RSVP) (Taylor and Taylor, 1983).

MRB Description

In order to assess the impact of the Rapid Serial Visual Presentation (RSVP) reading technique on reading speed and comprehension, a tool called Monolithic Reading Browser (MRB), which implements the RSVP reading technique, was developed.

Using MRB, the document is gradually displayed on the screen one word at a time. Essentially, MRB will bring the words to the reader's eyes instead of his/her eyes going to the words. One of the objectives in designing the MRB tool was to provide researchers with a workbench to conduct experiments in reading speed and comprehension using RSVP. The workbench includes the following four components: 1) survey, 2) RSVP display, 3) reading comprehension testing, and 4) tracking mechanisms.

1) Survey

The purpose of the Survey component is to collect demographic information from each subject who participates in a study.

2) RSVP Display

The purpose the RSVP display is to convert a text document into a RSVP style by displaying one word at time. There are two versions of this application. One allows the researcher to conduct a controlled experiment by presetting the parameters which determine the visual display characteristics. Some of the parameters include word speed, font type, font size, foreground color and background color.

The second version enables researchers to track user preferences for the same parameters when conducting experiments that allow for visual display personalization.

3) Reading Comprehension Testing

The purpose of this component is to determine the level of reading comprehension. Post-test questions are presented in multiple-choice format.

4) Tracking Mechanism

The purpose of this component is to track total time spent by the subject to complete the reading assignment. The subject is allowed in both MRB versions to pause, reverse and forward the RSVP during the experiment. This capability may cause the readers to have varying reading speeds.

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MRB was implemented in Java. MRB, Version 1 (see Figure 1), displays a text passage word by word at a pre-fixed speed (e.g., 150 words/min) and does not allow the subject to make any changes to the visual settings.

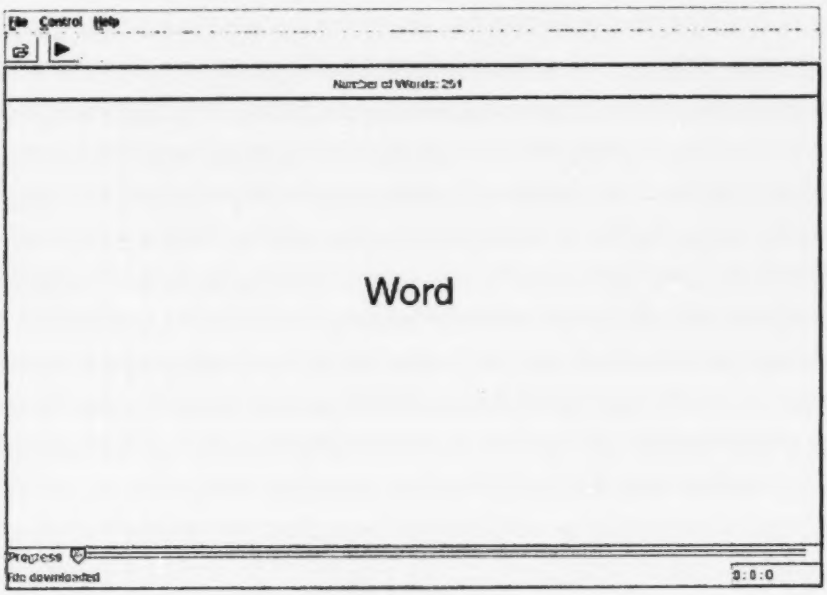

Figure 1: MRB, Version 1

The subject has access to the tool functionality through a menu and a toolbar. There are three menus: File, Control and Help. Figure 2 shows the toolbar and summarizes the functionality.

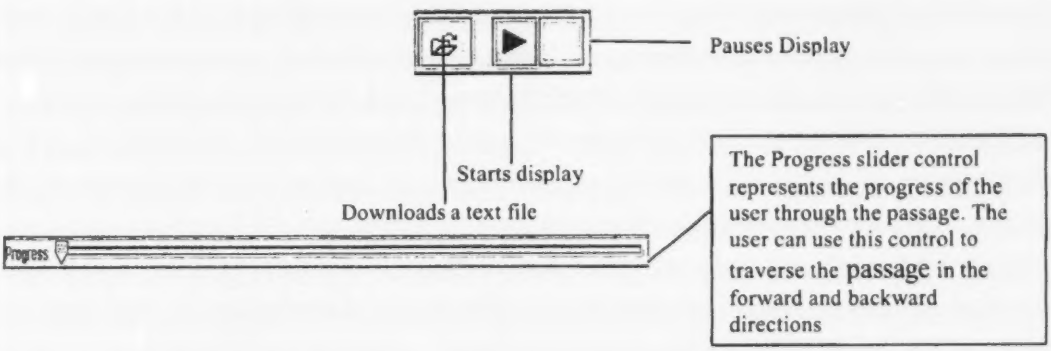
Pauses Display
Starts display
Downloads a text file
Progress
The Progress slider control represents the progress of the user through the passage. The user can use this control to traverse the passage in the forward and backward directions

Figure 2: MRB, Version 1, toolbar and progress control component

The user can start by downloading a file. When the download is complete, a message box pops up, informs the user that the download is complete, and gives further instructions. The user may then start reading the file by pressing the "Start" button or selecting the Control/Start menu option. The user can freeze the display anytime by pressing the "Pause" button or selecting the Control/Pause option. In addition, the user can traverse forward or backward through the passage by using the progress control.

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When the end of passage is reached, a message box pops up and informs the user accordingly. The user can then proceed to the reading comprehension component. Once a user has started the examination, the reading passage can't be reentered.

MRB, Version 2 (see Figure 3), provides users with the capability to personalize visual settings and word speed.

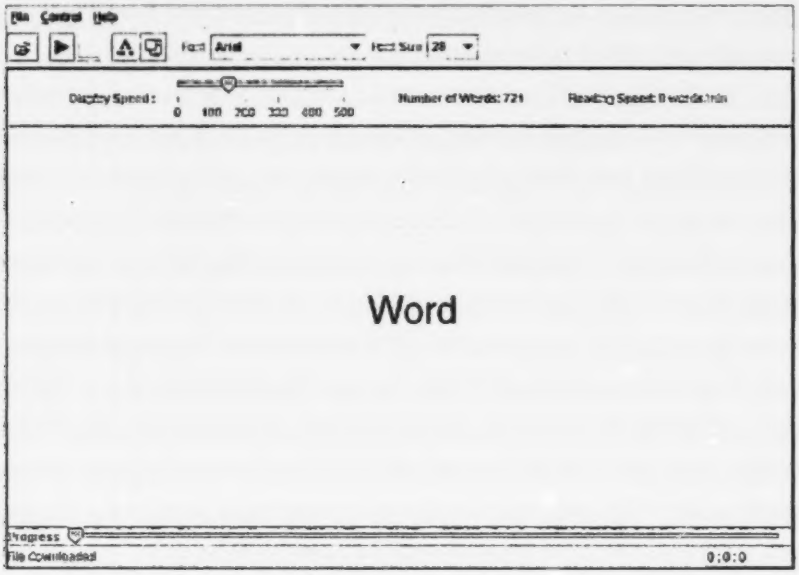

Figure 3: MRB, Version 2

As in version 1, the tool functionality can be accessed through the menu options or the toolbar. The menus are similar to version 1. Figure 4 shows the toolbar and display speed slider used in Version 2 and summarizes the additional functionality.

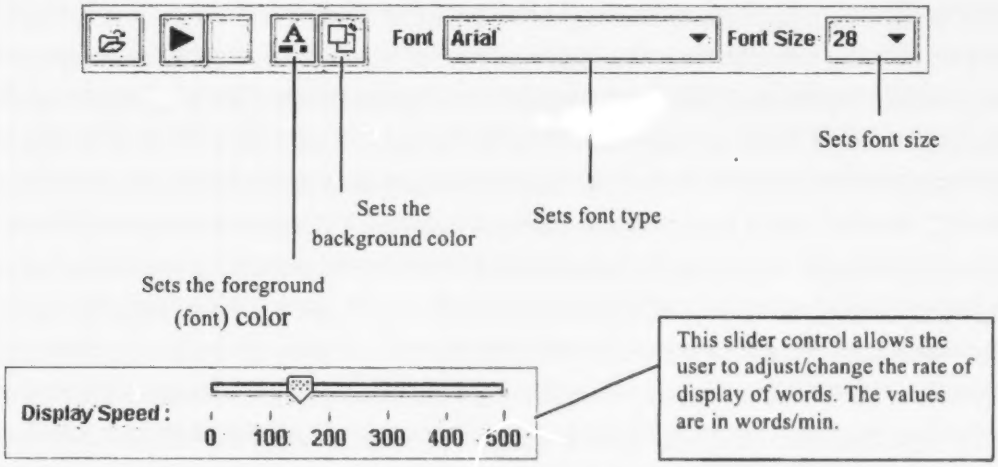

Figure 4: MRB, Version 2, toolbar and other components

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The functionality of icons present in Version 1 and Version 2 are consistent. In addition, by using the new controls, the subject can manipulate the visual variables and display rate according to his/her preferences.

Summary

Previous research carried out in the field of reading offers great insights into the cognitive processes involved in reading and recommends new reading techniques like RSVP. The MRB Tool implements the RSVP technique and will enable researchers to conduct experiments to investigate its effectiveness. The main reason and motivation for developing this workbench is the need to understand whether RSVP improves reading speed and comprehension This tool also provides an opportunity to study the changes users make to selected visual display variables.

Thus, future research using this workbench may shed some light on the effectiveness of the RSVP reading technique that may allow users to better traverse the vast information space available in the World Wide Web.

Reference

Taylor, Insup & Taylor Martin M. (1983) The Psychology of Reading Academic Press Inc.

Thinking through the web: the case of VirtualMente

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Abstract

VirtualMente is a web based scenario for displaying cognitive processes in university graduates. The name VirtualMente was coined combining two words virtual and mente (mind). The name stresses its virtual nature, a web scenario and targeted at cognitive competences. It is based on selected parts of the Triarchic Theory of Human Intelligence [1]. It focuses on metacomponents and insight processes. The structure consists of three dimensions: minds in action (problem solving, illustrations, self- assessment and collaborative glossary); minds in communication (horizontal interaction between participants through e-mail, chats and forums) and aids for the mind (suggestions for searching and selecting information and frequently asked questions). It includes materials coming from the local context and culture (songs, icons, words, cartoons) proposed by designers and participants. It promotes a collaborative atmosphere and demands continuous action from the participants. Content validity controls involve face validity and ecological validity. Procedures are content analysis and expert judgement. Available data come from a graduate level course on cognitive processes developed at the University of La Plata, Argentina. A demo version of VirtualMente and some data will be presented.

"Introduction"

The development of high level cognitive abilities such as critical thinking, reasoning, and problem solving, are considered to be important aspects of university education. To meet this goal, an online graduate level course on cognitive processing was developed and offered in Spanish at the National University of La Plata, Argentina.

The use of the Web is rather frequent in our University context for searching and exchanging information. Its use as a mediator for displaying cognitive processes is much less frequent.

Strictly speaking, VirtualMente is not a course for teaching how to learn or how to think. It assumes that users have previously developed the implied cognitive abilities. It intends to offer a chance to set cognitive processes in motion, both individually and cooperatively. It tries to build a relatively spontaneous atmosphere to foster personal initiative and interaction.

The main design features of VirtualMente include the following:

a-a conceptual framework based on the Triarchic Theory of Human Intelligence developed by R. Sternberg [2] [3]. The Triarchic Theory draws on the paradigm of human intelligence as a complex way of processing information, which is particularly pertinent to the traits of VirtualMente: a virtual environment designed for putting into practice cognitive processes (mainly metacomponents and insights). Sternberg [2] states that if you are interested in fostering cognitive processes in others, you have to previously develop your own. VirtualMente is an attempt to crystallize this principle. Mental self-government and autonomy are reflected in VirtualMente through the emphasis on the participants' activity.

b-the course is an example of computer-mediated communication where problems are posed and solved in a virtual setting. The discussion list and the communication via e-mail provide an impetus for horizontal and continued interaction. Contributions are judged on the basis of not strictly academic parameters. Criteria used to assess the contribution were: frequency by number of contributions and number of contribution referred to by others; quality by relevance, novelty, clarity and coherence; character of the contribution by discussion, opinions, self-assessment, questioning, reformulating peer contributions, formulating new ideas and soundness, by quality of the sources and documentation. The forum allows more experienced peers to support others and may lessen eventual tensions produced during the performance of cognitive tasks.

c-the fact that the language used in VirtualMente is Spanish constitutes an advantage over other Webs which require fluency in English.

d-some materials come from local traditions and modes. The data coming from the graduate level course shows that the challenge of finding elements from social experience and the local culture is a motivational force in computer-mediated communication.

e-as the program demands some knowledge of the Triarchic Theory an online assessment instrument called Monitor Triarchic Test (MTT) was developed. Completing the online test and deciding the moment of taking it is optional.

"VirtualMente Structure"

The structure of VirtualMente includes three dimensions: minds in action, minds in communication and aids for the mind.

Minds in action contains: problem solving, examples and illustrations, self- assessment, collaborative glossary, and other contributions from users.

Minds in communication implies: horizontal interaction between participants through e-mail, chats and forums (discussion list).

Aids for the mind gives: cues for navigating in VirtualMente, suggestions for searching and selecting information and frequently asked questions.

The resulting structure of the program is:

*flexible, the screens are not arranged in a linear sequence;
*interactive, allowing participants to enter data or commands, and
*minimalist, controlling the amount of the information given.

It was considered desirable that the icon selected to give identity to VirtualMente should be culturally relevant. After an extensive search in magazines, comics, and advertisements, it was decided to adapt the icon used to advertise a popular

analgesic called Geniol. The original icon consisted of a big head with pins and nails that symbolized headache. We kept only the head.

A survey of 100 university students on the semantic charge of words associated with "thinking" was done. The data indicated the Spanish word "mente" (mind) as the best equivalent of thinking. This link supported the decision to include "mente" in the coined name for the program.

An interesting finding was that a colloquial word "mate", it was located on the top of the ranking.

"Mate" refers to a typical beverage of Argentina and other South American countries. Saying that someone has "mate" means that he/she is clever or witty.

Due to the cultural significance of the "mate", we are currently considering to use it as the icon of the program.

The multimedia environment of VirtualMente includes two extracts of modern tango composed by a leading Argentine musician, Astor Piazolla. This composer is considered as a reformer of tango Music. He introduced a different way of conceiving tango. It is hoped that this special kind of tango may engage people to think in a non routine way. Whenever VirtualMente is presented, people's first reaction show astonishment to hear tango in this scenario. The Music tries to focus attention at the onset of VirtualMente creating a climate with a local taste.

"Validity Controls"

A pilot study of VirtualMente was conducted to evaluate the course using a sample of 15 university teachers and researchers from different disciplines. They were enrolled in studies of Computing Technology Applied to Education (Faculty of Computer Sciences. National University of La Plata).

Content analysis was performed to determine participant reactions to using the Triarchic Theory. It was considered relevant for inducing and displaying cognitive processes. Also as a guide to select material for illustrating the three kinds of intelligence. The metacomponents are seen useful as strategies for navigating through VirtualMente.

As it is previously said, an online assessment instrument on the Triarchic Theory was developed (MTT).
Comments of the participants indicate that assigning responsibility for discussing the content, and proposing changes, increase interest in the online format. Moreover, changes in presentation, ways of going through the test, structure and content, will be taking into consideration for preparing the complete online version bearing in mind the answering styles of the audience.

Participants also advised to avoid a linear, rigid sequence. A free transit through the test is considered more coherent with the nature of VirtualMente. They added that the beep following the wrong choice may affect the careful consideration of the text.

Related to the appropriateness of the icon participants said that the Geniol head, in spite of not having pins or nails, was traditionally linked with headache. Therefore, this representation may be transferred to VirtualMente. It was suggested that another icon to represent VirtualMente has to be considered.

"Final Remarks"

It seems that it is possible to include cultural materials into a course about human intelligence and cognitive processing through a virtual environment. In this case words, icons, habits, music and comics were used to put mental powers into action. From the standpoint of the Triarchic Theory the contributions made by the participants showed analytical and creative competences (metacomponents and insights). In both cases, interaction face-to-face and via e-mail was helpful. Metacomponential abilities were displayed in the application of constructs and principles of the Triarchic Theory to the specific purpose of the program, in monitoring self-progress and in making profit from the Internet resources. Creative abilities were shown in the searching, selection and adaptation of cultural materials relevant to VirtualMente.

"References"

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[3] R. Sternberg, *Successful Intelligence. How practical and creative intelligence determine success in life*. Simon & Shuster, USA, 1996.

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A Three-Level Analysis Supporting Courseware Development

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Abstract: The preparation of material to be published on the Internet is becoming relevant for many educational institutions. The present paper introduces an iterative semi-automatic development stragegy making use of quantitative measures able to assist the developer to reach the final course organization. The proposed approach offers two basic advantages: the development is done by taking into account pertinent material available from the Internet, furthermore the produced courseware is structured in terms of reusable web pages that can be collected into a local repository.

Introduction

The paper focuses on the production of hypertextual material suitable for teaching/learning activities (*courseware development*), which is a hot topic within the *web-based teaching/learning* research field (e.g., IEEE LTSC (LTSC, 2001) and ADLNet (ADLNet, 2001)). It is known that the courseware development is a high time-consuming (and therefore expensive) task. Very recently few ad-hoc methodologies have been proposed with the common aim of reducing the courseware development efforts (e.g., (Downes, 2000; Spalter and Simpson, 2000; Vittorini and Di Felice, 2000)). It is interesting to remark that all such proposals suggest the adoption of some kind of reuse which, in principle, can lead to a dramatic reduction of the development costs.

From the practical point of view, the idea of doing reuse is strongly motivated by the estimates lately published by the Institute for Higher Education Policy (CHEA, 1999) which assert that the 85% of the four-year American colleges plan to offer courses online by the 2002. In such a scenario, it is reasonable to foresee that very soon there will be available from the web thousands of pages with similar content concerning any subject (e.g., mathematics, physics, biology, chemistry, programming languages, and so on).

Courseware development is a young research topic with a lot of open challenges, some of them being related to the specificity of the context. For example, the sharp separation between the customer and the developer(s) that historically characterizes the software engineering field where programs are written by (teams of) programmers skilled in computer science, but without any specific knowledge in the problem domain, does not work in the new context, where the knowledge about the problem goes far beyond the programming technicalities.

Within this paper, we assume that the courseware developer is the teacher himself which is, therefore, responsible for the content and the structuring of the teaching/learning material, as well. In practical terms, this assumption implies that the teacher has to know the basics about Internet and HTML, moreover, he must be able to make use of a composer. Where we can help him is during the courseware development process, by making available a supporting methodology suitable to guide his design choises. The design and implementation of a software tool supporting a courseware development methodology is the final aim of our research activity. The present paper gives a contribution in this direction. In the remainder of this section its content is briefly outlined.

The first section introduces the formal framework where a "quantitative" design methodology should be placed. Specifically, metrics able to measure the textual, multimedia and hypertextual content of web pages are taken into account. Here we refer to the three metrics proposed in (Vittorini and Di Felice, 2001) to that purpose and their relative ranges of acceptance. Web pages falling outside those ranges are considered not suitable for reuse.

The second section focuses on an iterative courseware development strategy. Starting from an initial organization of the course, at each iteration step the organization is analysed and, if necessary, is refined. The analysis

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is performed at three different levels. Initially (the *high-level analysis*) the courseware organization is judged in terms of a global score which summarizes the overall textual-multimedia-hypertextual content of the web pages. If the score is below a fixed threshold (that means that the courseware organization is not satisfactory) the causes of the low quality of pages are further investigated (the *medium-, low-level analysis*) by looking in sequence at the paragraphs, the hyperlinks and the images and carrting out transformations. The process is stopped when the global score overcomes the threshold. Two basic operations (namely *splitting* and *joining*) are introduced as tools for the reorganization of the structure of the courseware under development.

The third ection presents an example of courseware development. This offers the opportunity to focuses on the practical usage of the three-level iterative strategy and the splitting/joining operations, as well.

The fourth section ends the paper.

Courseware development: preliminary considerations

The usual way to support the development "for/with" reuse in the software engineering field is to adopt metrics (that is quantitative measures for decision making). With the same aim, in (Vittorini and Di Felice, 2001) the authors introduced quantitative parameters to make measurements about web pages. The parameters taken into account are the number of paragraphs, images and hyperlinks existing within a web page. Finding the appropriate ranges of values for a given set of parameters is not an easy task since they depend on many unrelated factors like, for instance, the topic of the course, the background of the students, and so on. To overcome these difficulties we determined experimentally the extremes of the three parameters mentioned above through the analysis of a large number of web pages in the courseware context. The results are summarized in table 1, where $\mathcal{N}_\mathcal{P}$, $\mathcal{N}_\mathcal{I}$, $\mathcal{N}_\mathcal{A}$ denotes, respectively, the number of paragraphs of text, the number of images, and the number of (internal/external) hyperlinks existing within a web page.

Parameter	$\mathcal{N}_\mathcal{P}$	$\mathcal{N}_\mathcal{I}$	$\mathcal{N}_\mathcal{A}$
Interval	$[2, 20]$	$[1, 7]$	$[2, 15]$

Table 1: The ranges of values for $\mathcal{N}_\mathcal{P}$, $\mathcal{N}_\mathcal{I}$ and $\mathcal{N}_\mathcal{A}$, (Vittorini and Di Felice, 2001)

Below, we introduce the concepts of *teaching unit*, *allowable interval*, *reusable unit* and *course* and link them to the previous three parameters.

Teaching unit *A teaching unit is hypertextual teaching/learning material describing a specific concept.*

The definition is qualitative and offers to the teacher the maximum freedom in the creation of teaching units to be assembled into courses.

Allowable interval *An allowable interval is the closed interval $[k_{min}, k_{max}]$, where $k_{min}, k_{max} \in \mathbb{N}$, in which a certain parameter is permitted to lie in-between.*

We state that the allowable intervals for the parameters $\mathcal{N}_\mathcal{P}$, $\mathcal{N}_\mathcal{I}$ and $\mathcal{N}_\mathcal{A}$ are the intervals listed in table 1.

Reusable unit *A reusable unit is a teaching unit whose number of paragraphs, images and hyperlinks belongs to the corresponding allowable interval.*

Course *A course is a labeled ordered tree where each node is either a teaching unit or a reusable unit.*

The tree is labeled by the names of the teaching/reusable units, while the ordering is given by their sequence.

The three-level analysis

Aim of this section is to delineate a strategy which aids the teacher in the process of courseware development through an iterative three-level analysis. In summary, at the high-level of the analysis, the courseware is taken into account as a whole, by characterizing its structure in terms of a global score. In the case the score is below a certain threshold (which means that the organization of the courseware is not satisfactory), the analysis at the medium- and low-level provides guidelines for carrying out transformations of the organization of the course with respect to the textual content, the hyperlink structure or the images contribution. The process is iterated until a satisfactory global score (and hence a satisfactory organization) is achieved.

High-level analysis The evaluation of the organization of a courseware as a whole is performed by making use of the *score* $\mathcal{S}_{\mathcal{M}_\mathcal{C}}$, (Vittorini and Di Felice, 2001), which ranges in the interval $[0, 1]$: the highest is the score and the highest is the quality (and viceversa). A score below a certain threshold θ means an unsatisfactory organization.

Medium-level analysis The score $\mathcal{S}_{\mathcal{M}_\mathcal{C}}$ merges together three *metrics* which take as input a set of web pages and return statistical distributions about the number of paragraphs of text, the area covered by the images and the number of (internal/external) hyperlinks. The score $\mathcal{S}_{\mathcal{M}_\mathcal{C}}$ of a given courseware is obtained by comparing the distributions produced by the courseware to distributions chosen as references, by making use of the following equation (which is a simplified version of that proposed in (Vittorini and Di Felice, 2001)):

$$\mathcal{S}_{\mathcal{M}_\mathcal{C}} = \frac{1}{3}\left((1 - KS_{\mathcal{M}_\mathcal{P}}) \cdot \mathcal{S}_{\mathcal{M}_\mathcal{P}} + (1 - KS_{\mathcal{M}_\mathcal{I}}) \cdot \mathcal{S}_{\mathcal{M}_\mathcal{I}} + (1 - KS_{\mathcal{M}_\mathcal{A}}) \cdot \mathcal{S}_{\mathcal{M}_\mathcal{A}}\right) \quad (1)$$

The comparison concerns both the *shapes* of the distributions and the actual content of the *web pages* which produced such distributions. In detail:

- the coefficients $KS_{\mathcal{M}_\mathcal{P}}$, $KS_{\mathcal{M}_\mathcal{I}}$ and $KS_{\mathcal{M}_\mathcal{A}}$ refer to, respectively, the shape of the distributions of the paragraphs, the images and the hyperlinks. Their values are computed by performing the Kolmogorov-Smirnov test (F. J. Massey Jr., 1951), which measures how close is an experimental distribution to a theoretical one. In the following, the shorthand KS is used to generically refer to $KS_{\mathcal{M}_\mathcal{P}}$, $KS_{\mathcal{M}_\mathcal{I}}$ or $KS_{\mathcal{M}_\mathcal{A}}$. Since the lowest is KS and the closest are the distributions, the experimental distribution is satisfactory if the value of KS is below a fixed threshold χ;
- the coefficients $\mathcal{S}_{\mathcal{M}_\mathcal{P}}$, $\mathcal{S}_{\mathcal{M}_\mathcal{I}}$ and $\mathcal{S}_{\mathcal{M}_\mathcal{A}}$ (hereafter called the *partial scores*) address how similar the web pages under investigation are to the reference ones ($\mathcal{S}_{\mathcal{M}_\mathcal{P}}$ counts the number of paragraphs, $\mathcal{S}_{\mathcal{M}_\mathcal{I}}$ evaluates the area covered by the images, $\mathcal{S}_{\mathcal{M}_\mathcal{A}}$ counts the number of (internal/external) hyperlinks). A certain content is satisfactory if the corresponding partial score is over the threshold θ.

The medium-level analysis helps to understand which of the textual/hypertextual/ multimedia content of the pages composing the courseware is unsatisfactory (i.e., either the respective $KS > \chi$ or the partial score is below the threshold θ) and, hence, needs to be reorganized. In the case of more than one unsatisfactory content, we suggest to proceed to the reorganization accordingly to the following *order of relevance*: the textual content first (either $\mathcal{S}_{\mathcal{M}_\mathcal{P}}$ or $KS_{\mathcal{M}_\mathcal{P}}$), then the hypertextual content (either $\mathcal{S}_{\mathcal{M}_\mathcal{A}}$ or $KS_{\mathcal{M}_\mathcal{A}}$), and finally the multimedia content (either $\mathcal{S}_{\mathcal{M}_\mathcal{I}}$ or $KS_{\mathcal{M}_\mathcal{I}}$).

Low-level analysis The improvement of the courseware organization takes place at this level by *splitting/joining* the unsatisfactory web pages.

In connection with the splitting operation the critical issue is *where* to cut without giving rise to broken paragraphs/sentences. The proposal is to split paragraphs automatically by cutting at the level of the headings tags of HTML from `H1` to `H6`. The motivation behind this choice stands in the similitude existing between books and web pages: the titles of the chapters are first-level headings (`H1` tag), the titles of the sections are second-level headings (`H2` tag) and so on. The splitting operation at the level of the hyperlinks or images

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has to be performed *semi-automatically* by asking the teacher about the cutting point, because there are no safe methods to be applied without encountering the problem mentioned above.

In connection with the joining operation the critical issue is *what* to join without giving rise to bigger teaching units with heterogeneous content. Obviously, the joining operation has to involve consecutive teaching units lying at the same level of the course tree, nevertheless the final result may be unsatisfactory. Therefore, also this operation has to be performed under the direct control of the developer (i.e., semi-automatically).

In the next section we expand the discussion of the *splitting/joining* operations through an example. The thresholds $\theta = 0.5$ and $\chi = 0.5$ are adopted.

Courseware development: an example

Let us refer to the case of a teacher who plans to start the writing of an introductory course about Java and the basic concepts behind the publication of documents on the web. Figure 1 depicts the course structure as thought by the developer at the initial stage of the development. To keep the presentation of the example simple, we refer to the following situation: the development of the web pages about Java is done from scratch, while the development of the remaining part starts from digital material taken from the Internet (namely the ninth chapter of the "Java and XML" book, available online and titled "Web Publishing Frameworks" (McLaughlin, 2000)). Below, we focus on the the development of those two parts starting from the second.

Figure 1: The initial organization of the course

Iteration 1 The high-level analysis of the available web page returns $\mathcal{S}_{\mathcal{M}_\mathcal{G}} = 0.0$. Because $\mathcal{S}_{\mathcal{M}_\mathcal{G}} < \theta$, he starts the medium-level analysis obtaining: $KS_{\mathcal{M}_\mathcal{P}}$, $KS_{\mathcal{M}_\mathcal{I}}$ and $KS_{\mathcal{M}_\mathcal{A}}$ all over the threshold χ and the partial scores all equal to zero. Since none of the textual/hypertextual/multimedia content is satisfactory, the low-level analysis has to be carried out. The result is $\mathcal{N}_\mathcal{P} = 191$, $\mathcal{N}_\mathcal{A} = 90$, $\mathcal{N}_\mathcal{I} = 9$, that is, the number of paragraphs, images and hyperlinks are all over the respective upper bounds (Tab. 1). According to the order of relevance introduced above, the paragraphs have to be splitted first. By cutting at the level of the H2 tags (notice that the initial web page is a chapter, then the splitting must take place at the section level), six teaching units are identified (Fig. 2).

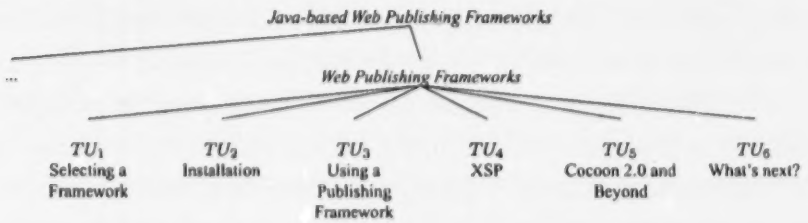

Figure 2: The organization of the course at the end of the first iteration

Iteration 2 This time: $\mathcal{S}_{\mathcal{M}_\mathcal{G}} = 0.43 < \theta$. Because the score is still not satisfactory, then the medium-level analysis needs to be carried out. The results are listed in table 2.

Because $\mathcal{S}_{\mathcal{M}_\mathcal{P}} = 0.39 < \theta$, the developer focuses on the textual content of the web pages. The results of the low-level analysis are listed in table 3.

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TAG	KS	S
P	0.19	0.39
A	0.31	0.63
IMG	0.43	1.00

Table 2: The values from the medium-level analysis (second iteration)

TU	*Title*	N_P	N_I	N_A
1	Selecting a Framework	23	0	9
2	Installation	34	1	11
3	Using a Publishing Framework	50	5	31
4	XSP	60	3	20
5	Cocoon 2.0 and Beyond	14	0	5
6	What's next?	10	0	14

Table 3: The values from the low-level analysis (second iteration)

By proceeding in the analysis of all the teaching units of table 3, at the end we get the result of figure 3.

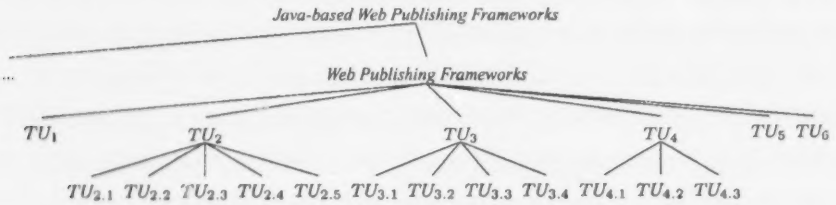

Figure 3: The organization of the course at the end of the second iteration

Iteration 3 Continuing in the activity of writing the example course, the teacher adds from scratch six new teaching units about Java data types and a latter teaching unit containing an example of usage of those data types. In numbers, suppose that each of the first six teaching units is one paragraph of text long and has no images, while the last teaching unit is made up of ten paragraphs of text and contains one image. Finally, all the teaching units have a short navigational panel made up of two hyperlinks necessary to move up and down.

The output of the high-level analysis applied to the whole set of pages being part of the current material is $S_{\mathcal{M}_G} = 0.47$. Since the score is under the fixed threshold, the medium- low-level analysis have to be performed (Tab. 4 and Tab. 5).

TAG	KS	S
P	0.23	0.57
A	0.29	0.66
IMG	0.49	1.00

Table 4: The values from the medium-level analysis (third iteration)

As can be noticed the first new six teaching units have a small number of paragraphs. In order to make them reusable they should be joined. From this consideration and from the examination of their semantics the teacher safely decides to join them together into a single teaching unit (TU_{join}). Hence a new iteration is started.

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TU	*Title*	$N_{\mathcal{P}}$	$N_{\mathcal{I}}$	$N_{\mathcal{A}}$
1-6	...	...	...	...
7	Boolean	1	0	2
8	Integer	1	0	2
9	Character	1	0	2
10	Float	1	0	2
11	String	1	0	2
12	Object	1	0	2
13	Example	10	1	2

Table 5: The values from the low-level analysis (third iteration) restricted to the new seven teaching units

Iteration 4 The result of the high-level analysis is $\mathcal{S}_{\mathcal{M}_0} = 0.56 > \theta$. Such score is satisfactory, therefore the iteration process can be stopped.

As a positive side-effect, the analysis performed above leads to the identification of seven reusable units.

Conclusions

The paper proposed an iterative semi-automatic strategy aiming to support teachers willing to develop courseware to be available from the web. The final objective of this research is to embed such a methodology into a software tool able to assist the teachers of our faculty during the development and publication of courseware on the portal of the university. Because of the heterogeneity of the operating systems currently used in our faculty (Windows, Unix, Linux and MacOS), Java2 has been chosen as the implementation language. The research presented in the paper is part of a long term project whose aim is to establish new complete degree programs available online in the fields of *Computer Science*, *Telecommunication*, and *Microelectronics*.

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Initiating cross-cultural attitude change through the implementation of an oral history web-based course

Yianna Vovides

This paper describes a work-in-progress project. The project is the design of an online course where students from two different cultures work collaboratively to put together a joint oral history project. It is expected that through the collaborative process and their individual work in the development of the joint project that there will be an awareness of cross-cultural commonalities that could initiate attitude change.

The course is being designed for use in Cyprus. Cyprus has been divided since 1974, with a largely Turkish population in the north and Greek population in the south.

Cross-cultural learning can be thought of as a form of experiential learning that occurs when the learner comes in direct contact with another culture (Neff, 1981, Flack, 1991). Some of the variables influencing successful cross-cultural experiences are language skills, communications skills, friendliness, attitudes, interactions, reinforcing activities, socially appropriate behaviors, and more (Pearson, 1981). This paper proposes the development and use of a web-based oral history course to provide the beginnings of this kind of cross-cultural learning.

The formation of attitudes and the way attitudes change is a dynamic process, one that inherently takes place over a long period of time, across generations. Attitude formation is dependent on the acceptance of the opinions and viewpoints in the community; i.e., the social norms (Tinker, 1991). These social norms are the standards in a society that influence the behavior of its members (Schafer, 1981). Therefore, understanding the origin and spread of viewpoints and how individuals integrate them with their individual personalities becomes critical. This integration can lead to the development of habits, and these habits can be very difficult to change. In attempting to change cross-cultural attitudes this becomes a critical issue, as societal norms themselves will need to be changed (Smolicz, 1983).

Beliefs, values, and personal needs also influence attitudes and how they change. The information one has about any concept will of course influence the attitudes one holds about that concept. Also, general feelings about what is "desirable" or "undesirable" affect attitudes (Schafer, 1981). People from different cultures will have beliefs and assumptions, attitudes and values, that cause them to interpret what is communicated to them through language and actions based on their own familiar cultural patterns (Lankard, 1994). Understanding the reasons behind an attitude means that one needs to understand the cultural patterns; only then does some form of change of that particular attitude becomes possible. Understanding the past can help in seeing the origins of generalizations (Gillet, 1992).

Peace education and effective conflict resolution are necessary and inevitable in cross-cultural learning when it involves two groups that have regarded each other as enemies. Dialogue among people of different backgrounds emphasizing their experiences can play a major role in breaking down stereotypes and in overcoming prejudices (Koschel, 1993). The Forum for Multicultural Communication in Jerusalem focuses on the study of interethnic relations of the Arab-Jewish communities. The Forum's programs attempt to establish human relations on a personal level by having workshops on conflict resolution, cross-cultural dialogues, international conferences in promoting peace education, etc. (Yaron, 1993). Programs such as these are being implemented in Cyprus on a limited basis.

Cross-cultural understanding, open-mindedness, and resistance to stereotyping or derision of cultural difference are important factors in developing a global perspective (Merryfield, 1995). Organizing curricula to include cultural contact, borrowing and diffusion of ideas, and comparison of themes and concepts can help bring separate cultures together (Anderson, 1990). This can be defined as global education. One of the important considerations in global education is the idea of cross-cultural experience.

Encouraging students' respect for other viewpoints, developing critical thinking skills, and emphasizing the importance of team work for learning become necessary in affecting cross-cultural attitudes (Lankard, 1994). Krathwohl's affective taxonomy can be used to guide the objectives and learning outcomes of the proposed oral history course (Linn & Gronlund, 1995).

An oral history project will help students understand how to design, implement, and complete an activity. Its very nature increases student involvement as students learn that history is the collective memories of actual events that directly affected the lives of their friends, acquaintances, and relatives (Siler, 1996). This has the potential to influence the attitudes of the students, since through this oral history project the students will gain an awareness of where the two cultures come together and where they pull apart. Revisiting history functions as a way to alter the perceptions the students hold about past events (Gillet, 1992). This awareness can impact how the students see the future, raising their consciousness about cultural differences (Smith & Otero, 1977). Cultural awareness is the development of sensitivity to cultural differences, which requires examination of perceptions and modification of their behaviors to fit in different cultural contexts (Smith & Otero, 1977).

As part of the process, students learn to create and administer various interview instruments, they improve their questioning skills (initial and follow-up questions), enhance their writing and listening skills, and gain organizational skills pertaining to time, energy, and information. A good background knowledge of the historical topic and time period is an essential part of the process. This needs to occur before beginning the project as the focus of the project, and is dependent on the students' understanding of the issues involved.

The media that can be used for this project can vary from simply interviewing the participants and taking notes, to using tapes to record the interviews, to the use of video. The integration of video and text-based materials in hypermedia applications supports the possibility of multiple perspectives as it utilizes different mental representations (Swan, 1995). The end project can be published in the traditional way (book or booklet) or via the WWW, which can then be used in the curriculum of other history classes on Cyprus for both elementary and secondary education. The WWW will allow the students to use multimedia and will make the project more interactive, allowing it to reach a larger range of different learners. In general, oral history projects foster a sense of responsibility and promote active participation and collaboration in the learning process.

Research on learning from hypermedia applications suggests that instructional applications can be designed in ways that support students' development of historical thinking. In a web-based instruction course, the combination of media will help the students develop a clearer understanding of people, places, and events of other times and cultures (Swan, 1995). There is some indication that assignment of students of different races to work with each other has positive effects on race relations while teacher workshops, minority history, and classroom discussions of race relations have limited effects on the students' social attitudes and behaviors (Slavin & Madden, 1979). The cooperative nature of the oral history project will therefore also help the students develop multicultural awareness and perhaps even cross-ethnic friendships.

Technology in distance learning is one of its most crucial ingredients. Its ability to reach the learners that are not well served by conventional educational institutions, to meet the newly emerging educational needs of an information society in better ways, and to improve the quality of learning may well be able to create breakthroughs that have proved elusive in the past (Bates, 1995). The Internet and the WWW help overcome the some of the barriers of time and space in teaching and learning (Kerka, 1996; Collis and Remmers, 1997). The nature of the WWW provides an excellent opportunity for collaborative learning through cooperative efforts to occur over distance and to affect attitudes.

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On Security Issues in Internet-Based Distance Education

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Abstract

Over the past few years Internet-based distance education has become a very prosperous area of both research and educational practice. In this paper we examine some security issues in Internet-based distance education. We first discuss some important uses of the Internet for distance education; We then examine certain security issues associated with these uses of the Internet in distance education; By this paper we make our contributions to the scientific and educational community by clearly pointing out these security issues to draw more serious attention, and some approaches to resolving some of the issues.

Keywords: E-Learning, Internet-based distance education, information security, students' privacy, Internet security, availability of information service, distance education, World Wide Web.

1 Introduction

Distance education [5, 6, 13, 9, 10, 7, 8, 14, 4, 16, 11, 12] provides learning opportunities to people who are traditionally restricted from access to and success in university-level studies [4].

Regardless the differences between different distance education models [18], one important feature that is common to different distance education systems is the use of some means to connect the educational institution to students at certain distance rather than in campus. Before the 90s necessary connections between students and instructors in distance education was achieved by one or a combination of the following technologies: regular mail, telephone, voice-mail, radio and TV broadcasting, and telephone conference. It is not difficult to see that each of these means of contact has certain disadvantages. For example, regular mail is too slow and often incurs some significant delay; telephone or telephone conference is too expensive and not widely available; Radio and TV broadcasting are not interactive. It is the Internet, and the World Wide Web that in particular is revolutionising distance education systems.

In general, the Internet and the World Wide Web have been, or have the potential to be used in the following ways for distance education:

- First of all, the Web has been used as a publishing media to carry all sorts of course materials including texts, pictures, images, sounds, audio and video clips.
- Secondly, the Internet and the World Wide Web has been used as an efficient communication channel for instruction, discussion and cooperation. This use is different from the first due to its interactivity.
- Thirdly, the World Wide Web is a wonderful place to build live laboratories. By using today's advanced Web-enabled technology such as XML and Java programming, we are now able to demonstrate and/or simulate many important scientific and technological principles and processes using the Web, and able to get students work with these simulation and experiments interactively.
- Finally, the Internet has the potential to be a platform for distributed computing. In fact, some distributed applications have already been implemented on the Internet. For example, educators can manage and process their course materials and students files across the Web, and students can study and practise their skills and

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carry out required experiments and do their homework from anywhere they can access the Internet and the Web.

The popularity of the Web in distance education is also due to its many advantages over the traditional means for implementation of distance education. For example,

- courses offered via Internet-based distance education can be reached by people from all over the world;
- Furthermore, data transmission over the Web is much faster than many other means. A learner with Internet-based distance education can get updated course materials within a minute or even second;
- Thirdly, in Internet-based distance education course materials can be delivered in multimedia, and learners can interact with the teaching system and even instructors on the other side of the world;
- Fourthly, course materials are easy access on learners' schedule because the Internet and the course server are normally available twenty-four hours a day and seven days a week;
- Finally and most interestingly, in Internet-based distance education students can meet new friends in a very big virtual campus no one has ever experienced before.

We therefore believe that the Internet and the World Wide Web will have some significant impact on the future of our distance education as well as education as a whole, because of the so many uses and the advantages of these uses that could lead to many fundamental changes to our education systems.

2 Security Issues and problems involved in Internet-based distance education

Distance education mainly involves two parties: the learners and the educators. Each of these parties may have different interests from which different security concerns may arise.

For educators, their interest in providing distance education over the World Wide Web can be at least one of the follows:

- Funded by the government or organisations to provide free educational service to the people. Although it is free, the quality, such as availability, of the service still need to be maintained at a higher level for various reasons. Therefore, they also have certain security concerns in order to keep their systems in good working order, and to make their courses assessable.
- Making profit from offering courses over the World Wide Web. These people or organisation have the most concern about the security of their Internet-based distance education systems.
- Being a certification authority. Even if they do not make money from providing Internet-based distance education, these people still have their security concern in order to maintain their authority and keep their certification trustable.

For the learners, on the other hand, their interest in taking courses via distance education can be at least one of the follows:

- For pleasure and fun. These people like to learn so much, and Internet-based distance education can help them realise their dreams without leaving their cosy homes.
- To prove their capabilities of learning something. Because they are mostly self-motivated, there is often no need to authenticate them for assignments and exams.
- Updating their knowledge and skills for jobs and living. What these students care more about is whether they can really acquire the knowledge and skills they wish to have. Assessment and certification are not so important for them.

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- Pursuing qualifications in a specific area. These students can be for jobs as well, but they must be assessed by the authority of educational institution for pursued qualification.

Information security can be an issue whenever privacy of individuals or organisations, integrity of information, availability of information services and non-repudiation of commitment is concerned. As we can see, however, educators and learners with different interests may have different security concerns or to different extent. In the rest of this section we shall examine security issues that concern either educators or learners in Internet-based distance education.

2.1 Availability of online course

As for any information service, amongst some other issues [3] the availability of Internet-based courses is the first security issue we should consider in implementing Internet-based distance education systems, regardless their interest as we discussed above. We shouldn't say we have provided the Internet-based distance education to students at all if our students couldn't access the courses.

The course availability issue may arise from several sources. In this paper we examine only two of them.

First of all, due to the infrastructure of the Internet available today, for many students dial-up over ordinary telephone line is still the main access to the Internet. This reality decides that they cannot stay online very long. As such, some online course materials may become unavailable for the students if all the course materials are organised and kept in such a way that students will have to stay online in order to study the course.

To resolve this issue, we may allow students to download all the course material in a bulk to their own computers so that they can study off-line. However, to make course material available for students in such a way, we need to resolve some other problems. We first need to try our best to reduce the size of the bulk so that students' connection time can be minimised; Moreover, we also need to consider how the course material kept on students' machine can be updated in a timely fashion [19, 20].

Secondly, course material may become unavailable if the server suffers from denial attacks so that it denies normal accesses from students. Since this is a general threat to all information service providers on the Web, we may find some counter-measures from other application areas of the World Wide Web. As such, we are not going to discuss it in detail here.

2.2 To protect students' privacy

Unlike traditional education, in Internet-based distance education students files are transmitted over the open and unsecured Internet, and often stored on computers that can be accessed to via the Internet. Therefore, students have more concern about their personal data, their e-mails and conference data presented at the course conference, and the privacy of their activity on the Web [2]. Unlike students in traditional universities, students in Internet-based distance education are more worried about third parties who may take the advantage of the Internet to get their personal data either from the course server or during the time of transmission.

To resolve these issues, we must first make our best effort at protecting students' files and data. Meanwhile, we also should try to make students believe that their privacy is sufficiently protected. To achieve these goals, we can do in security practice at least two things. One is to standardise Internet-based distance education including the structure of course materials and methods of delivery [15], and based on these standards we can choose or develop some standardised and/or specialised course delivery tools instead of those general Internet tools; Secondly, we could give students more control over their own files and data, except the assignments and exams' results, of course.

2.3 Secrecy of course materials

Unless the Internet-based distance education is provided as free service as we have discussed at the beginning of this section, the authorities of Internet-based distance education providers often want their course materials be kept secret from people who are not authenticated to access the course material. However, it is very difficult to achieve this security goal in practice. Even though all the course materials are kept on a central server of the education provider, and the students are required to authenticate themselves every time they wish to study the course, once they have been authenticated, we have no means to know who is actually sitting there and using the computer and the Internet connection to consume our product.

A more serious secrecy issue is with the assignments. Because in distance education students are often not starting to take a course at the same time, some students may do the assignments earlier than others so that other students can get assignments and even with answers from their mates much earlier than they should, and start to work on it. We thus have no control on the time they should spend on the assignment. This can be a critical issue if the results of assignments are taken into account for the final assessment and evaluation for certain credit or qualifications.

Moreover, the secrecy of exam papers is a much more critical issue in Internet-based distance education. Because students taking the same course may be on different paces, it is impossible to ask the students who already wrote the exam not to tell other students about the contents of the exam.

To resolve these issues, the only solution is to have enough number of different versions of assignments and exam papers, but this will significantly increase the workload of instructors.

2.4 Virus and malicious code

In Internet-based distance education, computers used by both students and educators, including administrators and responsible course coordinators as well as tutors, must be protected from virus and malicious code. For the latter, because nowadays universities and other organisations generally have licensed and updated anti-virus software installed on their computers, their computers should be relatively safe against virus that might come with students assignments and e-mails, as long as the anti-virus software can be trusted. However, these anti-virus software may not be able to defeat or even detect malicious code of student-made programs. In such a case, we may have to test these code on a special computer if we have any doubt about the normality of our students.

With regard to virus attacks on computers, students are indeed more vulnerable because they usually do not have updated anti-virus software installed on their computers. For educators in Internet-based distance education, it can be more serious if they get their students' computers infected by virus. They may eventually lose these students if the infections occur so often, or are very serious.

To resolve this issue, it may be a wise practice for educators to release some of the responsibilities for protecting students machines to students themselves in some way. For example, if the educator can set up course service on students' own machines, we may give students the responsibility for protecting their own computers from virus, as long as no virus comes with the course material initially.

2.5 Copyright issues with online course materials

Copyright of material used in teaching is always an issue for any educational organisations. It becomes more serious in Internet-based distance education because of some special features of the Internet and World Wide Web [17].

In Internet-based distance education, HTML documents used for a course on the Web often contains hyperlinks to other documents on the Web, which in turn may contain links to other documents, and this process may go on forever. In addition to the fact that the original author of an online course may never know what have been indirectly linked to the course, the status of these linked documents is also changing over time. Broken links are definitely frustrating for students who are reading the course, though that has nothing to do with copyright. What crucial to the author of an Internet-based course with regard to copyright is that one day the author of one linked document may claim copyright on his/her work that were copyright-free originally.

What can we do to resolve this copyright issue then? We would have less risk of copyright violation if we put no external links in the course, but doing that we will lose the main advantage of the Web.

It is obvious that we need to have a suite of more practical copyright laws and regulations for the Web. Such laws are necessary for an Internet-based course author not only for avoiding charges for possible copyright violation when using external links, but also for protecting the copyright of his or her own work — online course materials.

2.6 System administration for information security

Advanced security theory, technology and tools such as firewalls are definitely necessary for computer and Internet security, but many real security problems often arise from bad system administration. In other words, to achieve our security goals in Internet-based distance education, networked computer systems need to be deliberately configured. For example, we can adopt a layered approach to configure our computer networks for providing Internet-based distance education.

In all kinds of business, things about money may be the most sensitive information that needs to be protected. As such, in Internet-based distance education we may put student payment information on a machine behind very tight firewall with no external access. Next to this layer we can set up a shared workspaces for students, to which students may be able to access via different network protocols, while student access to httpd can be put at another layer. For some very student specific things, we may even clear ourselves from any security violation by leaving them on students' own machines.

In tightening up system configuration for security, one more thing that needs to be seriously considered is the trade-off generally between convenience and security. For example, it may be a good security practice to shut down **telnet** and **ftp** on a server, in order to protect the system. However, it is also well-known that **telnet** and **ftp** offer users easier access to some data and services. A general rule for deciding whether or not a server should run **telnet** and **ftp** services may be that, do not run **telnet** or **ftp** services on a computer unless it is necessary. It is also a good practice to put sensitive documents and services on separate machines on which neither **telnet** nor **ftp** is running.

3 Conclusion and future work

We have discussed in this paper a variety of security issues associated with Internet-based distance education. These issues include ensuring the availability of course material, protecting the privacy of students taking Internet-based online courses, protecting computers of both educators and students from virus and malicious code, as well as preventing possible violation of copyright when using external Web documents via external hyperlinks. We also pointed out some possible solutions to some of these security problems.

Our next step in investigating security issues with Internet-based distance education is to further develop and evaluate security measures that can be used to resolve these security issues we have discussed in this paper. Amongst many tasks to be carried out, the first one would be to find out a better way to make and keep our courses available to more students all over the world. The second and maybe the most difficult security research in Internet-based distance education might be to find a better way to authenticate students for accessing online course materials, doing assignments and writing exams online. We consider the last task a big challenge to the Internet security community.

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Effects of Paper-based Versus Paperless Approaches on *e*Learning in the Conventional Classroom

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Abstract: This study will examine the role of paper-based versus "paperless" approaches to classroom instruction. Two groups of graduate students in an educational technology class will be the subjects in this study. All students will have access to a variety of electronic modalities (Web, ftp/file server, class listserv) for receiving, sharing and submitting class materials, but one group will be limited exclusively to electronic methods while the other group will carry out all class activities using paper at the primary methodology. The difference between paper-based and paperless approaches on student attitude, student performance, and their perceptions of the effectiveness of delivery will be investigated.

Background

Recently, the copy machine in our department broke due to overuse. As in many academic departments, this happened after a long history of heavy demand for copies on the part of instructors as well as administrative entreaties to reduce the amount of physical duplication. The resulting administrative dilemma was familiar: should the machine be replaced? If so, should it be replaced with a copier of greater or lesser capacity?

Being well prepared for class is an obligation of being an instructor. There is a clear need for class materials and activity guides for use in classes, but it's not at all clear that the only effective means of distribution for these materials is on paper. In fact, there is also a need for reliable and valid tools that will allow instructors to teach effectively without distribution of paper handouts (for example, the authors' own institution now places many reserve readings on the World Wide Web via the university library). In fact, Lancaster (1978) suggested that paperless communication is unavoidable in the process of technological development. Indeed, current advances in technology allow classroom teachers to change the traditional teaching technique of using paper (or print) to a paperless (electronic) technique. In the research, some studies have indicated that paperless techniques can be beneficial in augmenting traditional classroom techniques (see, for example, "The Duke Paperless Classroom" in Stetten & Guthrie, 1995; Lackie, 1998). Paperless *e*Learning not only can solve these problems but may also convey educational advantages of its own.

The Study

This study will explore the relative effectiveness of paper-based vs. paperless classroom formats on various aspects of the effectiveness of course delivery and students attitudes as well as performance in a graduate educational technology course within a traditional classroom setting. The student behaviors in question will be patterns of accessing class materials (paper-based or paperless) and patterns of behavior in submitting assignments. Outcomes will be effectiveness of course delivery and student attitudes as well as task performance.

A centralized class file server has significant advantages as a locus where students may store, organize, submit and share their class work (see Wang, 2001). This class will use an Internet-based file server. Students will be given a server account and be taught how to use a free ftp program to access the class file server. A class common folder will be created on the server for the instructor to post class handouts, and other class materials and discussion information. Peer-to-peer file sharing between the instructor/student and student/student will be posted and accessed through this common folder as well. Three network-based modalities (the Web, class file/ftp server, and electronic mailing list) will be used to distribute class-related materials to and from the students regardless of location and group.

Subjects will be graduate students from two sections of an educational technology course taught at a midwestern state university. Approximately 40 participants will be classified into either the control group or experimental group. Subjects in the paper-based group will serve as the control group. While they will have access to class materials in electronic form, and may submit class work electronically if they wish, they will receive copies of all class materials in traditional ink-on-paper form and will be required to submit all class work on paper. Subjects in the paperless group will serve as the experimental group. They will neither submit nor receive paper; all class materials and all assignments to be submitted will be handled electronically through the three network-based modalities mentioned previously (Web, class server, and/or mailing list).

An attitude survey questionnaire covering students' computer background and a comparison between their attitudes toward conventional paper and *e*Learning paperless approaches will be administered at the beginning of the term. An identical attitude survey (minus the computer background section) will be administered at the end of the term. Furthermore, survey questionnaires addressing the effectiveness of course delivery and change in communication patterns from conventional paper format to *e*Learning paperless format will be administered at the end of term. The score differences between the two groups will be used as the subjects' performance gain scores difference.

All the experimental material delivery, survey, and data collection will be administered online. Survey data on course evaluation regarding the effectiveness of course delivery and communication patterns changed from conventional paper format to *e*Learning paperless format will collected by the computer programs. A one-way Analysis of Covariance (ANCOVA) model will be used to determine the differences in course delivery between paper and paperless classroom formats while controlling for students prior attitudes toward *e*Learning course. The effectiveness of course delivery is the primary dependent variable while paper-based vs. paperless classroom format is the primary independent variable.

Significance

The study is educationally significant in several ways. First, it is one of the few pilot studies researching the relationship among classroom format (paper-based vs. paperless), student attitude, and student performance. Secondly, if the effectiveness in course delivery of the "paperless" is found to be equal or better than the "paper-based" classroom format, the finding will support efforts to curb the rampant use of paper, ink, printer, and copy machine. Moreover, extensive use of electronic course material may also convey certain advantages of its own. Finally, the study can be used as a prototype toward developing paperless *e*Learning within a conventional classroom, which immerses students in the infinite Internet.

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Architecture of Education Support System, Based on Knowledge Management Paradigm

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Currently, the learning environments supported through Internet/Intranet are very popular in addition to the distance learning, satellite learning and so on, which have been widely promoted by public organizations. This type of learning is different from the learning style to be performed in our traditional lecture room. The difference is mainly derived from the gap between virtual world and real world. The traditional learning is constrained by various conditional features, attended inherently with the physical space. On the other hand, the learning in the virtual world is very exciting and interest in points of organizing the border-less environment and supporting the self-oriented participation style, but is not always effective in short of direct face-to-face interaction.

The current and future trends about computer-supported learning enforce the utilization of Internet/Intranet environment exactly. In the collaborative learning, the research interests were mainly how to organize the unspecified participants friendly, how to promote active actions/reactions of individuals, how to construct effective interfaces among participants, and so on. However, though it is important to encourage the creativeness and understanding-abilities of participants, many investigations which have been focused on until today did not always address such complicated subjects directly, except some researches[3].

In this paper, we address an architecture of education support system with a view to integrating various types of educational functions cooperatively. Our idea is to look upon educational activities as a kind of knowledge management. Namely, various educational activities can be categorized into 4 classes with respect to the constructive relationships between the number of teacher and that of students. The educational activities in these 4 classes can be explained on the basis of knowledge-handling process in the knowledge management model: SECI model. SECI model was firstly proposed by I.Nonaka[1] as a knowledge-based strategy in the information society, and is a successful paradigm for supporting creative activities of individuals in the industrial and cooperative organizations.

SECI model contains 4 concepts, related to the knowledge management process: Socialization, Externalization, Combination and Internalization. We make use of this SECI model to arrange various kinds of education support systems in accordance with the characteristics of knowledge understanding processes or human behaviors on education activities. First, we categorize educational activities into 4 classes according to 4 different terms: private and public; and teaching and learning[2]. The categories of educational activities are self-learning, group learning, public lecture and private lesson. These educational activities are distinguished in accordance with the number of students and the existence of teacher: in (x, y), (0, 1) is self-learning, (0 , n) is group learning, (1, n) is public lecture and (1, 1) is private lesson. The self-learning corresponds to Socialization because the knowledge for student is newly acquired or increasingly added without any structural improvement. The group learning does to Externalization because the acquired knowledge of student is explicitly refined through the discussion and opinion-exchange. The public lecture does to Combination because the refined

knowledge of student is integrated systematically by the superior teacher. Also, the private lesson does to Internalization because the integrated knowledge of student is expanded implicitly by the repeated exercises.

1) Self-learning: This type of educational activity is supported by CAL (Computer Aided Learning). Namely, a student acquires the knowledge by himself and the education support system has to provide student-control interaction mechanism.
2) Group learning: This type of educational activity is covered by CSCL (Computer Support Collaborative Learning). Namely, a student refines the acquired knowledge by discussing with other students or exchanging their opinions cooperatively. The education support system has to support a group interaction mechanism among students so that participated students can cooperatively discuss and exchange their opinions effectively.
3) Public lecture: This type of educational activity is performed by CAI (Computer Aided Instruction). Namely, students are instructed systematically by a teacher, and students can integrate the newly instructed knowledge into the existing knowledge.
4) Private lesson: This type of educational activity is implemented by ITS (Intelligent Tutoring System)or ICAI (Intelligent Computer Aided Instruction). Namely, the student can expand his knowledge with help of tutor under the system-control interaction mechanism.

These 4 types of education support systems are currently integrated and developed under the individual education domains, and are not always sufficient to manage the total learning/teaching environment from a viewpoint of knowledge-based spiral process in SECI model. In order to support a unified educational activity space, these existing education support systems are systematically organized with respect to their interactive relationship. Figure 1 illustrates that our framework of education support system is adaptable to the knowledge management paradigm in SECI model. Of course, in our framework the knowledge spiral which is first from Socialization to Externalization, second from Externalization to Combination, third from Combination to Internalization, and fourth from Internalization to Socialization, is not always explicitly controlled, but these 4 educational activities are timely exchangeable.

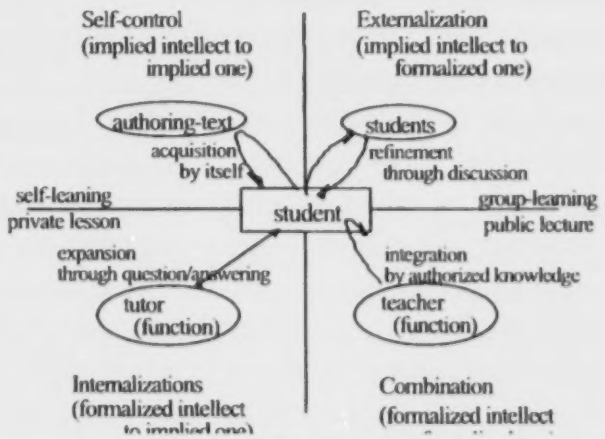

Figure 1: Education support and SECI model

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Evaluating Educational Websites: Towards a Theory-based Schema

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Abstract:

This paper explores issues surrounding the notion of evaluation of educational websites. The aim of the paper is to chart the terrain around this problem so that educators and researchers can apply a flexible but theory-grounded tool for meaningful selection and evaluation of educational Websites. This paper is structured in two parts: Part I discusses relevant literature on the use of the Web in education and asks what are the aims, objectives, processes and various modes of evaluation in this kind of context. Part II tries to integrate these answers with an instructional philosophy and strategic model into a framework for evaluation, towards a generic, versatile evaluation schema.

Introduction

With an ever-expanding role in education and instruction that the Web is taking comes an increased responsibility on educators to make mindful, effective use of the platform and to understand the pedagogical implications that the Web has in the classroom and on the competencies of learners. Having said that, even the most robust *design* methodologies do not guarantee learning performance. At the same time, meaningful *evaluation* of educational Websites is often an opaque and variable activity, where incommensurate online resources can be hard to compare and to gauge and where the outcomes of evaluations can be largely subjective, incomplete and non-transferable. A desired side effect is that this evaluation framework could lead to the articulation and study of further relevant research questions, while helping to formalize the instructional use of the Web in educational settings.

Part I

The Educational Applications of the Web: Aims, Objectives and Modes of Evaluation

To set the context and gain some orientation, this section asks what is the aim of evaluating an educational Web site? What objectives does evaluation serve? What is it that ought to be evaluated and what kinds formats of evaluation should be regarded as important? A process for developing an evaluation schema is also described. Part of the approach of this paper involves understanding what it is that actually makes up an educational Web site in the first place, and thus, what are the various dimensions of educational Web sites that give clues to a framework for measurement and evaluation.

a. Aims of Evaluation

The main aim of evaluating an instructional Web site is to build a picture of how well, if at all, it works to support and provide learning and instruction. Evaluation, according to Jonassen (1992), "implies an appraisal or value judgement...relative to some criteria" (pp.145). Evaluation findings can have various uses and applications, from *summative* to *formative* for example, but the overriding aim is usually to assess the caliber, merits and worth as well as *limitations* of an online resource in a given educational context. The findings of an evaluation – i.e. the picture which emerges - could be useful for various 'stakeholders', from the instructors themselves, to the learners, the designers, program managers, school managers, instructional technologists and researchers, and even sometimes the parents. It's important that this 'picture' which emerges is therefore clear and informative for the target audience.

b. Objectives of Evaluation

With these general aims, what are the more specific objectives of evaluating an educational Web site? Aside from the main aims outlined above, a meaningful answer to this question involves stepping back somewhat and asking what is it exactly that's being evaluated such that we would need to define any objectives at all? We might list a wide range of aspects, features and elements that could potentially be evaluated in an instructional Web site, for example:

Overall Learner experience
Learner performance: Specific to general
Instructional *methods* used
Content: Quality, Clarity, Coherence

Web site Organization/Logic
Comparative: Other similar sites
Functionality
Specific Tools for e.g. *Interactivity*
Usability
Technical platforms
Design fundamentals: e.g. use of ADDIE or other principles
Aesthetics
and so on...

In the case of an educational Web site, a *high-level* evaluation ought to cover to some extent how well, how effectively, the Web is being used to effect a learner's integration, long-term storage and transferability of knowledge. Thus, any integrated evaluation model should therefore reflect a *full scope of educational modalities* that the web offers. This poses us with a problem of identifying a meaningful set of Web-based educational modalities.

One approach to the characterization of educational modalities offered by the Web, is that of Nachmias (1999) and his colleagues Mioduser et al (2000) who've attempted to taxonomise educational Web sites by classifying the structure and functionality of online learning environments. Briefly, their taxonomy incorporates general descriptive elements, elements related to the underlying pedagogical-instructional model of the environment, elements characterizing the knowledge and representational structure, and elements to classify the types of communication which the Web site supports.

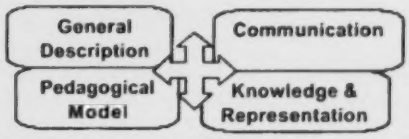

Fig 1. Overview of Nachmias' (1999) taxonomy of Web-based education modalities.

In fact, in order to arrive at that modal structure, Nachmias (1999) reviewed and agglomerated a wide range of other taxonomies. One, Harasim (1993), describes seven instructional modalities: "expert based (electure, ask-an-expert, mentorship, tutor-support); and student based (access to information, peer interaction, structured group activity)". Berge (1995) and Collins (1995) propose 14 instructional modes such as "mentoring, project-based instruction, lecturing, information retrieval, chat, peer reviewing and others together with Web-versions of traditional CAI modes (e.g., tutorials, simulations, drills)". Another, Berenfeld (1996), suggest five modes, "tele-access to information, virtual publishing, tele-presence, tele-mentoring and tele-sharing". Riel (1993) on the other hand emphasized the importance of "multicultural sensitivity and understanding" and underscores the role of electronic communities in project-based instructional tasks. By contrast, a more cognitive-educational perspective is described by Teles (1993) who discusses "Web-based support of cognitive apprenticeship by features that embody a variety of methods (e.g., sequencing, scaffolding, exploration, reflection) in online-apprenticeship or tele-apprenticeship activities". Nachmias argues that a mapping between the many different properties of taxonomies of an educational Web site, combined with a generic, flexible and 'future-proof' structure, when placed alongside precise terminology, classifications and definitions should form the basis of a viable taxonomy. Nachmias recognizes the complexity of the problem of taxonomising instructional applications and modalities of the Web, and yet certain aspects of any such taxonomy are regarded as crucial and they cut across the various modalities described above: These include *content, pedagogy and communications.*

Thus, to return to our question 'what are the specific objectives of evaluating an educational Web site?' an important step here is to recognize the problem space that is shared between our question and the solution that Nachmias proposes to the problem of taxonomizing educational modalities in Web-based learning environments: The three characteristics of Nachmias' taxonomy, general as they may be at this stage, ought also to figure in our evaluation schema in that the objectives are to be as comprehensive ("*high-level*") as possible in analyzing and qualitatively assessing an instructional Web site. With this basic grounding, let us consider some more practical questions about what this evaluation schema could 'look like' and how it can be built up.

c. Formats of Evaluation

An evaluation could be based on a range of research tools; interviews with individual users, observation of focus groups, questionnaires or surveys, or more rigorous quantitatively-orientated test measures. This paper will not discuss the pros and cons of different research design strategies, but rather outline a kind of 'wish list' for the format of the evaluation schema. Briefly, the evaluation should have the following features:

The evaluation takes the form of a 'checklist' of items that are worded so as to provide for reactions from evaluators on a value-laden scale,

The use of a scale (1-7) to measure gradients of a property and provide numerical values corresponding to items that can in

turn be used in statistical analyses,
Evaluation findings should include visual maps of the evaluation 'terrain' providing for a clear visual overview, comparative reference,
The evaluation should support both individual and group participation,
The evaluation should be 'modular' so as to provide for flexibility, adaptability and scalability.

d. A Process for Developing an Evaluation Schema

Once the ontological requirements of an evaluation schema are met and the format of representation of the schema has been defined, a meaningful process for situating and organizing that logic into en evaluation schema can be defined. The 'wish list' for the format of the evaluation points towards the use of structured *concept maps*. For this purpose, Trochim (undated paper) describes a process for *concept mapping* that serves evaluation particularly well for group-orientated activities. Trochim's ideal concept map can form the basis of an evaluation and can guide evaluation development.

The modalities described above (Trochim's "clusters") that will be further articulated below into evaluation statements can be viewed as measurement constructs that can be included in the evaluation 'checklist' alongside a rating response. Indeed, "alternatively," Trochim writes, "if a more multimethod approach to measurement was desired, the group could make sure that within each cluster several different types of measures were constructed to reflect the cluster. The exciting prospect here is that the concept map provides a useful way to operationalize multitrait-multimethod approaches to measurement".

Part II

Towards an Evaluation Framework

This section tries to integrate the outcome of the discussion above on the modalities and taxonomies of educational Web-sites and the more practical aspects of evaluation, with a more sharply defined strategic model. The intent is to outline a first framework for evaluation and to move towards a grounded, yet generic evaluation schema.

a. A Strategically-Oriented Evaluation Modality

The discussion on the objectives of evaluation in Part I and the analysis of taxonomies and modalities in educational Web sites in the literature led us to a conclusion by Nachmias (1999) that three meaningful elements of a taxonomy for evaluation that cut across the relevant modalities include *content, pedagogy and communications*. In a paper on "*Instructional Strategies for the WWW*", Plass and Whelan (2000) described a strategic model of the instructional use of the Web was developed into which applications and adaptations of the Web can be categorized. The advantage of the "3D Model" was that it incorporated a significant number of other strategic taxonomies as well as that of Nachmias', thus deepening the theoretical grounding of the model. To recap the 3D model:

> "The first dimension, the *Knowledge Mode*, relates to the epistemological approach taken to knowing and learning by describing how learning materials are organized, manipulated and created. The second dimension relates to the nature and complexity of the *Presentation Modes* being used to represent information, from text-only to an immersion into a virtual environment, which corresponds to the *symbol system* category of media attributes. The third dimension, *Collaboration*, situates the instruction in a social setting and describes the level of interaction with other learners, corresponding to the *social settings and situations* class of media attributes."

The objective with this 3-D model is to "bring structure, context and organization to instructional web configurations in accordance with specific instructional tasks and objectives". In this paper the next step is to 'unpack' this model in a constructivistic framework and incorporate it in finer granularity into the evaluation schema. To help with this, Jonassen (1992) offers "constructivistic criteria" which can be usefully applied within each of our three dimensions to give the desired granularity from which the process described at 1.e above can be launched. The criteria Jonassen describes are Authenticity; Knowledge Construction; Experientiality; Contextuality; Multimodality; and,Multiple-perspectives

b. Criteria & Elements of the Modalities

This matrix below expands the '3D Model' into an evaluation schema with elements that accord with Jonassen's constructivistic criteria. (We imagine this as equivalent to Steps 3 to 5 of Trochim's process.)

Criteria	Knowledge Mode	Presentation Mode	Collaboration Mode
Authenticity	Authentic, relevant tasks can be carried out. Informative factually correct tasks can be explored. Knowledge is meaningfully integrated.	Content presented is authentic, relevant. Texts, images, content is meaningful. Interactivity is relevant, authentic.	Social experience is integrate. Communication is meaningful and relevant. Group work and interaction is authentic.
Knowledge Construction	Original knowledge can be created. New resources are synthesized. New strategies or arguments can be made.	Content is accessible and searchable. Texts, images, resources can be utilized readily. Interface can be easily controlled, reconfigured.	Collaboration can be easily created. Communication can be creative, original. Groups can collectively create, synthesize.
Experientiality	Instruction is an ongoing continuous, fluid process. Learners interact with a rich set of activities. Learners experience varied, diverse materials.	Presentation is contiguous, coherent, coordinated. Texts, images, resources are inviting, attractive Interface is clear, integrated, user-friendly	Collaborative experiences are rich and fluid. Inter-personal exchange is fluid and continuous. Group work is supported by rich, varied tools.
Contextuality	Materials are structured at challenging level. Learning contexts are rich and genuine. Learning problems have real-world relevance.	Content is specific, yet integrated in context. Texts, images, resources have real-world contexts. Interactivity includes context-specific functionality.	Collaborative experience is contextually integrated. Communication can be structured by contexts. Group-work has meaningful real-world elements.
Multimodality	Materials & products take multiple forms. Learners create multi-faceted products, portfolios. Learning process can have multiple outcomes.	Content can be manipulated into multiple forms. Learning resources can be made into portfolios. Interface offers personalized multimedia creativity.	Collaborative experiences occur in multiple forms. Communication tools support multimodal products. Groups can collaborate on multimedia portfolios.
Multiple-perspectives	Instruction cover multiple perspectives, views. Multiple interpretations are explored. Learners interact with varied viewpoints.	Content includes multiple perspectives. Resources offer varied alternative viewpoints. Interface supports contrasted multiple perspectives.	Groups can explore multiple perspectives & views. Communication tools enable multi-perspectives. Collaboration incorporates multiple viewpoints.

Social Negotiation	Instruction incorporates negotiation of meanings. Collaboration and group work is central to process. Knowledge artifacts reflect subjective experiences.	Tools of negotiation have userfriendly presentation. Opinion can be tied to resources and content. Discussion and negotiation can be open or closed.

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c. From Evaluation Schema to Evaluation Map

A typical procedure in an evaluation of an educational Web site would be to select a website for review, assemble one or more evaluators, allow them to explore the site for a set amount of time, and then ask them to go through the list of statements and give each one a rating on a scale of 1 to 7. A numerical score would be compiled that reflects both the criteria and the 3 dimensions overall. Further statistical procedures would also be feasible. A next step would be to compile the results into a visual representation using shapes and/or layers to reflect values and weightings.

d. Conclusions

The intention of this paper has been to explore some of the terrain around the new problem of Web site evaluation so that educators, learners and researchers alike can consider new options in applying a flexible but theory-grounded tool for meaningful selection and evaluation of educational Websites. In this case, two theoretical frameworks – one concerned with the strategic use of instructional websites, the other focused on constructivistic evaluation – were interwoven and elaborated into an evaluative schema. The first framework is based on extensive research in the field while the second is more analytic in nature.

However, there are a wide range of unresolved issues raised in this kind of conceptual 'maneuvering'. Methodologically, the formation of the evaluation schema in this way is highly subjective, all the more so in this case because there was no 'real brainstorming' as Trochim would recommend. There has been no testing or validation of the elements, no clustering, no revisions for clarity; all this lays ahead. Many elements may be too crude or overly repeated or too vague, while some important elements may be missing entirely, such as more finely-grained cognitive-psychological indicators. The aim however was to begin a prolegomenon. Moreover, the use of Jonassen's explicitly constructivistic criteria might be said to bias the *Knowledge Mode*, a central component of the 3D model (akin to Nachmias' *Pedagogy* taxonomy), which was intended to fairly reflect any point along a spectrum from behavioristic or cognitivistic to constructivistic. One reply to make here is that the *criteria* are intended constructivistic, not the instructional methodology being evaluated *per se*.

As was mentioned at the outset, a desired side effect of this analysis is that this evaluation framework could lead to the articulation and study of further relevant research questions, while helping to formalize the instructional use of the Web in educational settings. This is indeed very ambitious, but some interesting issues have clearly arisen: as discussed in Plass and Whelan (2000), the three dimensions of the model can be individually, partially or fully reflected to varying degrees, as befits the instructional requirement and this introduces the possibility of *modularity* in the evaluation schema, albeit dependent on further validation of the schema itself.

Another set of issues is reflected in the structure and composition of the schema, and this echoes questions raised by Windshitl (1998) on research directions for Web-based learning. A concept central to instruction and clearly reflected in the schema here is that of Learning as Dialogue, meaning collaboration, communication, group interactivity and social negotiation of learning. This is something that information and communication technologies do well, but it raises Windshitl's questions about how social constructs are changing with these technologies, how learning groups are forming and interacting and how virtual learning groups differ from conventional, physical groups.

Finally, to return to the list of features and elements that could potentially be evaluated in an instructional Web site (as mentioned at *I.b.* above), while some features may not be explicitly included in the schema and others elaborated in great detail, but one argument that the schema implicitly makes is that it is possible to agglomerate multiple levels of explanation in order to provide a whole picture of an increasingly complex and multi-dimensional object, the educational Web site.

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WebNet'01 Panel Proposal:

Evaluation and the Web: eLearning, eCommerce, Entertainment

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1. Summary

This **Panel Proposal** outlines the main issues and challenges surrounding the notion of *evaluation of educational, eCommerce and entertainment websites*. The aim of the panel is to chart the terrain around the problem of evaluation so that developers and evaluators can begin to create a *hands-on* flexible but theory-grounded toolkit for meaningful evaluation of highly-functional Websites, keeping in mind the constraints of context, user requirements and technical infrastructures. Up to six experts will participate in the Panel. A desired side effect is that this toolkit or evaluation framework – developed in a **workshop** component of the Panel - could lead to the articulation and study of further relevant research questions, while helping to formalize the functional use of the Web in these very varied settings.

2. Objectives of the Panel

? ?To inform participants about key issues, strategies and research in Web Evaluation

? ?To share resources and models for Evaluation in the WWW, in particular in the domains of e-learning, e-commerce and e-entertainment

? ?To allow participants to discuss and develop their own context-specific-approaches to evaluation in workshop-style segment of the Panel

3. Strategies & Aims in Website Evaluation

For web developers today, the Web is becoming many, many things. Aside from being a chaotic, often daunting interface to something new and largely unknown, it's also an on-all-the-time library and reference service, a vast shopping mall, a global casino, a versatile communication arena, an environment that can enable creativity and exploration on the part of shoppers, gamblers and students alike. The growth of 'high-functionality' websites is increasingly pervasive.

But with an ever-expanding role that the Web is taking comes an increased responsibility on developers to make mindful and effective use of the platform and to understand the implications that the Web has in the classroom, at home and in the workplace. Having said that, even the most robust *design* methodologies do not guarantee profits or performance. Yet meaningful *evaluation* of Websites is often an opaque and variable activity, where the outcomes of evaluations can be largely subjective, incomplete and non-transferable.

Which Evaluation Methodologies are Effective?

A typical web evaluator often regards questionnaires as the primary method for eliciting evidence on usability of the sites. However it is not the only method and a wide variety of choices are available to fit the right context. This Panel will aim to explore the Evaluator's options for choosing the right methods for the right context. For example, depending on the context of the site, one could propose the *thinking*

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aloud protocol as an alternative evaluation approach. Other methods, such as the *heuristic approach*, have also proved suitable in specific contexts of the web.

But to what extend can traditional evaluation approaches be adapted to the web? More precisely, can heuristic evaluation be as successful in the application to e-learning, e-commerce and e-entertainment environments as it is proved to be in the evaluation of traditional interfaces? Two core issues related to this are, in turn, the expertise of the evaluators and the appropriateness of the heuristic list; they will also be discussed in detail. The Panel will present a taxonomy of the existing different strategies, describing the contexts where they best fit. These strategies include the application of analytic methods, expert-based methods and empirical methods (which involve users). Which modifications are necessary, which limitations are unavoidable and which strenghts of the methods can be unfolded concerning their adaptation to the web and in particular in the environments under consideration?

What are the Needs of Web Evaluator - in the Near Future?

Evaluation, according to Jonassen (1992), "implies an appraisal or value judgement... relative to some criteria" (pp.145). More concretely, "evaluation is concerned with gathering data about the usability of a design or product by a specified group of users for a particular activity within a specified environment or work context" (Preece et al., 1994, p.602). This definition is tailored to the particularities of the web. So, evaluation findings can have various uses and applications, from *summative* to *formative* for example, but the overriding aim is usually to assess the caliber, merits and worth as well as *limitations* of an online resource in a given educational or commercial or recreational context. Indeed, the *context* of the evaluation is pivotal inasmuch as one evaluation may involve different Websites - or different aspects of a given Website.

Moreover, the findings of an evaluation could be aimed at different 'stakeholders', from the developers themselves, to the users, the interaction designers, program managers, business managers, instructional technologists and gamblers, each of these groups may have different needs from the outcome of an evaluation. While an ideal evaluation is one that is 'custom-made' for a given resource, this may not always be feasible so it's important that a 'generic' evaluation framework is flexible and versatile enough to yield useful and informative insights for the target audience.

There are therefore many approaches to conduct an evaluation. But the need for innovative methodologies to be invented is obvious. We should be asking what is the aim of evaluating a high-functionality Website? What objectives does evaluation have to serve? Who are the stakeholders? What is it that ought to be evaluated and what kinds formats of evaluation should be regarded as important? This will be addressed in the Panel as part of a structured activity. The web is a new medium and needs its own approach in evaluation as it matures. The basic guidelines, the axioms, on which web evaluation must rely need to be clearly defined in order for new methodologies that are to be invented in the future to be built on strong foundations. Which are these? One should have a strong vision into the future, so the work of visioneers of the field is much appreciated on this part of the panel.

4. eLearning vs. eCommerce vs. Entertainment sites

Within the requirements of context, what are the more specific objectives of evaluating a high-functionality Website? How do eLearning, eCommerce and Entertainment sites differ, and what do they have in common? Aside from the main issues outlined above, a meaningful answer to this question involves stepping back somewhat and asking what is it exactly that's being evaluated such that we would need to define any context-specific objectives at all? We might list a wide range of aspects, features and elements that could potentially be evaluated in an instructional Website, for example:

- ?? *Overall* user experience
- ?? User performance: Specific to general
- ?? Interaction *methods* used
- ?? Content: Quality, Clarity, Coherence
- ?? Website Organization/Logic
- ?? Comparative: Other similar sites
- ?? Functionality
- ?? Specific Tools for e.g. *Interactivity*
- ?? Usability

?? Technical platforms
?? Design fundamentals: e.g. use of structured methods or other principles
?? Aesthetics
?? and so on…

E-Learning: E-learning is an issue of paramount importance for the future of education and training. Issues revolve around instructional effectiveness, enhanced learning performance and efficiency.

E-Commerce: eCommerce, by contrast is focused on economically efficient transactions, from product browsing, to purchasing, to user tracking and user fulfillment.

E-entertainment: Entertainment sites offer broader attractions but have informativeness and profit as key drivers. To give the visitor or the user an entertaining experience is the purpose of a high percentage of all web sites. This brings up the need for evaluating these web sites, in order to give guidance for design. Evaluating entertainment is different from evaluating systems and interfaces supporting such activities where efficiency with 'the shortest time required' as a measure of success. In the above cases 'the longer time the better' might be better, or time measuring perhaps does not correlate with experiences, entertainment and fun at all.

The success or failure of these above mentioned environments will thus be influenced by the potential of the applied evaluation techniques. To clarify this issue, a number of questions must be answered:

a. What is the overall aim or goal of the environment?

b. Who are the target audience?

c. Which evaluation strategy can be applied?

d. How can the results be assessed? Who will implement the findings?

6. Panel Workshop Exercises:

Split into groups of 3 or 4 persons, depending on the number of attendees, and draw out lists of key issues, obstacles and solutions for web evaluation in each domain, from the perspective of the user, developer and other intermediaries (e.g. teacher, business person etc.). The aim of the workshops is to attempt to tackle the questions described above with references to the personal experiences of the Panel participants and examples drawn from expertise.

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About the Lead Panelists

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Athanasis Karoulis is a high-school teacher of informatics and a post-doctoral scientific researcher in the Dept. of Informatics at the Aristotle University of Thessaloniki. He holds a Ph.D in HCI, and a M.Sc in Distance Learning. He is also a multimedia developer and lectures Multimedia and HCI at the Aristotle University.

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Robert Whelan holds a MSc in HCI & Ergonomics from University College London and is a Fulbright doctoral scholar in Educational Communications & Technology at New York University in the USA. He has also worked for the European Schoolnet in Brussels as a knowledge management system designer since 1998.

Other Participants (yet to be confirmed)

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Join the Joyride![1]:

An Identification of Three Important Factors

for Evaluation of On-line Entertainment.

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Abstract: This paper identify three different categories of entertainment in the Eurovision Song Contest web site. (1)Contest related content (2) Value-adding content (3). Design- and technology related entertainment. These types arose in an empirical study, a usability evaluation, conducted on twenty test persons. Methods used were usage of general forms, think-aloud protocol with task analysis in combination with a more 'free surf' approach. The level of intervention of the evaluators were also changed between tests. Finally, interviews, both about the web page and the experiment in itself were conducted. The tests were done with both single users as well as pair of users. The main purpose of the tests were to find guidelines in how to evaluate entertainment web sites. The findings show that there are actually guidance to give from out of the three categories of entertainment. Intervention could actually be a good thing sometimes, working together is both good and bad, depending on which of the above mentioned category we are striving to say something about and finally traditional task analysis is not all bad for testing entertainment after all.

Keywords
WWW, usability, evaluation, experience, entertainment, e-commerce

Introduction
Entertainment is a big trend on World Wide Web (Jensen, 2000). This paper presents findings from an evaluation of an entertainment- and experiment site. The project in called *Joyride!* and is part of the *Center for digital business*. The project is ongoing, and this paper reports from the first of three phases. Overall, the project will contain 180 user tests. For this first phase, 60 of those have been conducted. The first phase was conducted upon three entertainment web sites. This paper focuses on one of these sites, *Eurovision Song Contest (ESC)*, a web site built to support the TV-event broadcast worldwide in spring 2000, when Sweden hosted this contest. The overall purpose of the project is to develop new methods and criteria for measuring users' reactions to such web sites as entertainment - and experience web sites. The purpose of this paper is to describe the site and the experiment design and give some preliminary findings for how we can categorize entertainment web sites, in order to bring guidance in how usability tests of entertainment sites could be designed in the future. During the evaluation a number of different methods were used, as outlined below. We will try to give some guidance in questions like; What kind of result does the different test approaches give? What combinations of techniques are fruitful in such evaluations? What grade of intervention is appropriate? Should we use single-user tests or let the users work in pairs?

[1] The author wants to acknowledge Per Gessle, author of the song 'Join the Joyride', performed by his group Roxette.

The paper contains a broad overview of other work done in usability testing of entertainment and experience systems. More specific definitions of some core concepts related to the problem area is done. Further, an empirical overview is given as well as a description of the design of the evaluation site. Finally, conclusions are drawn from the findings of the tests, and future work in the next two iterations are described and discussed.

Related work

Related work are find in traditional usability engineering (c.f Nielsen, 1994). Overall, there has been a lot of usability studies made focusing on measuring effectiveness of different types. However, there is a need for new guidelines for designers as well as evaluators of web sites, for building successful entertainment sites. The device "the faster the better" does not work as a measures of success when it comes to such environments (Olsson, 2000). A lot of work have been done on web usability as well, however here a big focus on *information retrieval* is put (c.f. Spool, 1999). Furthermore, the concept of the new economy, by some called "The experience economy" are being explored by for instance Pine II and Gilmore. They give great guidance in exploring the concept of *experience*, and they present fruitful theoretical frameworks in order to bring some focus in search of guidance However, these authors do not have the intention of further work in evaluation of entertainment sites. They rest on a more general level of abstraction.There is a research field called *Affective Computing*. Rosalind W. Picard wrote a book with the same name (Picard, 1998). However, she is more into agents and person-like interfaces. This research field in general explores the notions of emotions and machines overall. This field has good potential of conducting answers on similar questions. One example of author working with similar questions is Pat Jordan. In his book *Designing Pleasurable Products* he gives guidance in different types of pleasures (Jordan, 2000). Also, he gives guidance in choosing methods for evaluations. However, in that book we get no empirical examples of how the methods work. Also, from our perspective the book is a bit general. It is a great book for argumentation that traditional usability is not enough however.In relation to the above mentioned related work it seems as there is a lack of empirical findings in guidance in evaluation of entertainment web sites, more specifically. It is our intention to fill this gap.

User tests

The user tests were planned in cooperation with the design company. They were interested in differences as well as similarities between the sites. Also, they had interest in the evaluation part. They provided fruitful feedback in the underlying purpose of the designs as well as the focus groups of users. This user groups were used in the finding of test persons. The focus group for *Eurovision Song Contest* was *"Adult person interested in popular music in general and more specifically Eurovision Song Contest"*.

The test persons

Inquiries of participation were sent out by e-mail to approximately 60 persons. The test crew sent it to most of the adult they knew in the local area. The issue of ESC interest, the crew left to the test persons to decide. This was not considered when choosing e-mail adresses. Among the group that got the e-mail, two groups could be spotted, i.e colleagues at the department of informatics at Umeå University and a minor group of informatics undergraduate students. The rest were more mixed in their profile. From these, the answers were handed on a 'first come - first serve' basis. In the end it showed out that all the interested could be tested. The number of tested users for ESC were overall 20. The reward for the tested users was a ticket to the cinema.

The test site

The tests were conducted in a computer lab in connection to the department of informatics. A PC was used as mostly of crowd of test persons had stated in answer form that they were PC-users. The test was conducted on a T3 connection. It could be argued that this type of sites are difficult to download when using a 56,6'modem. However, that was not something we had as a purpose of testing. Nevertheless, it is an important issue. A digital video camera was used to tape the think-aloud part of the test and a mini-disc player was used to record interviews. The video camera was focusing on the user mostly, but also covered some of the screen. The main purpose of the video camera, however, was to get the audio. Also, all tests were conducted with two evaluators. The test crew circled among the activities, but were always present at every time. This so the person not being active could evaluate both the test itself as well as the other evaluator. This really helped in the analysis of the data.

Methods used

First, the users filled in a general form, stating for instance age and interrest of ECS. For the latter, a scale from 1 to 7 was used. At the site, another form was used. Here the user answered questions also of very general character.

Examples of questions are *"How often do you use the web", "Do you use a computer at your work"* and so on. These stages all of the users went through. After this, the users were told to imagine a scenario. This with the main purpose to bring the time back to the day after the contest. Also, within the scenario they were told that they came back after a journey and that they wanted to update themselves in order to get a feeling of what happened the evening before. The purpose of this was solely to get them started and to give them a firm 'push' into the web site.

After this the evaluators used different types of test approaches.

- Some of the test persons did the tests together with a friend - others did it alone.
- Elaboration with the level of intervention from the evaluators.
- Some users got a 'free surf' period to start with - others got tasks at once. All of the users did *some* tasks. No user did *only* 'free surf'.
- The evaluators took turn in who was the main evaluator.
- Also, an iterative approach concerning questions in the interview were used and questions were added as well as taken away.

After the usage session, all users were interviewed. The ones working in pairs did pair interviews. Overall the tests took no more than one hour in total.

The web site - Eurovision Song Contest

The web site evaluated in this paper is, as said before, the support site for the TV-event with the same name. In 2000 the contest was held in Stockholm, Sweden, and the web site was built by Paregos AB[2]. Quoting the description of the web site from the corporate site of Paregos[3], the purpose of the site was:

> *"Swedish Television and Aftonbladet wanted a web site for the Eurovision Song Contest that was not just a pale copy of the television show and they wanted it to present the sponsors in a sensible way. The site were steadily the most visited for the weeks before and after the competition. The visitor can compete in a Song Quiz (with other visitors) and be his/her own DJ by mixing his/her own version of ABBA's Waterloo, and so on."* (http://www.paregos.com)

Eurovision Song Contest
The Shop is now open!
Questions about the contest
Do you have any questions about the Eurovision Song Contest?

Figure 1: The home page of the web site

The web site uses some plug-ins for the browser as *Macromedia Flash®, Beatnick® and Shockwave®*. The main menu is found in the upper left. In the very upper corner, a *back* and a *home* button is found. This because the browser goes into 'full screen mode' when the site is starting. At the upper right, changing of language (Swedish or English) could be done as well as information about the design team behind the web site could be found. An *Exit* button is put in the very upper right corner. Further below, in the pink area, there are some high-lighted entries. They end up at the same pages as in the menu - but they are more specific in their descriptions. In this area there are also

[2] The site is no longer in global use, as it is an event site. However, it can be found at *http://www.paregos.com/eurosong2000/*.

some clickable illustrations, which also are entries to underlying pages. In the very below there are links to external sources. The menu have entries like 'Welcome', 'On-line TV', 'Participate', 'Interactive zone', 'Past years', 'Other fun' 'Site map' 'Ask about ESC' 'News' and more. Under all these entries, lower level entries are found as well. For instance under 'Interactive zone', 'Screen saver', 'mix your own song' 'pop-quiz' could be found. The site will be further explored below.

Categories of entertainment on the site

When discussing entertainment web sites, the picture often gets a bit blurred. This is because the term 'entertainment' could mean many things. Nevertheless, it is important to grasp this issue to be able to find guidance in how to evaluate such sites. Our empirical findings from the think-aloud evaluations conducted, as well as the interviews of the users, shows that there are actually three categories of entertainment possible to identity on this site. Those categories are more thoroughly described below:

Figure 2: The' past years' page

1. ***Contest related content***; many people have knowledge of these events as a hobby. For instance, there is a club around the contest which you can join and get more knowledge as well as buy material, as a CD with all national winners in Turkey of all times. For some, this content is highly prioritized. Examples of this type of content are; lists of winners of all times, information about this year's contest, video-clips with all the songs, from parties after the finale. Empirical evidence for identifying this category was for instance, some of the persons tested, rated very high on the scale of interest of ESC. This type of person rated the contest related content as the best on the site. They were very amused of findings like 'Who won ESC 1981 in Dublin?'. On follow-up questions in relation to this comment, other types of content were used of the evaluators as examples and the person were asked if they, for instance, did not like the 'Waterloo remix'. One person expressed disappointment with this content and said *"it was not as good as the real thing"*. ***Methodological findings:*** Here, traditional task analysis gave good results. Any question seemed interesting and amusing. To answer questions became a game in itself. The users corresponding positively to this type of entertainment on the site saw no difference in how they would handle the contest related content by themselves compared to conducting the test. Interventions as positive feedback when finding right answer seemed important, for highly ESC scoring as those not as interested. This is different from traditional guidelines for task analysis which says that interventions dangers the result *if done during* the task being conducted.

2. ***The value-adding content***; The site holds other types of content than such that is strictly related to the content in itself , as downloadable screen savers, ability to send post cards, small games and possibility to remix music. The Waterloo remix (see figure 3) could also be sent to a friend. Also, information of more general kind could be found, as gossip and other light-weight information. This type of entertainment amused the

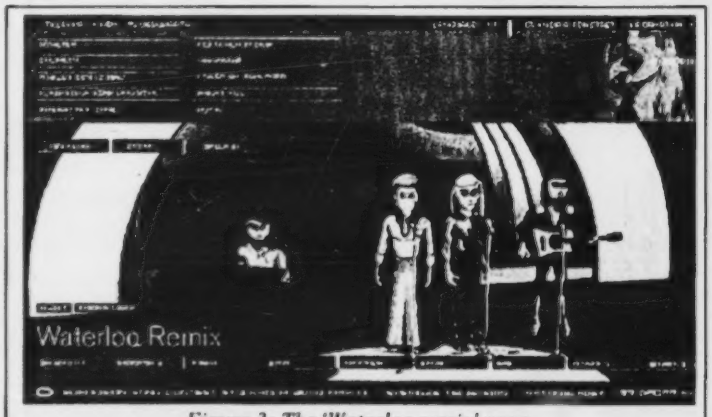

Figure 3: The 'Waterloo remix' page

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majority of the tested users. On the question of what was the best of the site, many said 'the Waterloo remix'. They also added that this type of content was the thing that could bring them back to the site or the reason to recommend the site to others. The only ones not responding positively to this content type was the highest and lowest rated on the 'interest for ESC' - the ones in between were positive. Many tested users also said that this type of entertainment was a type they had come across before on the web, and that they sometimes searched for this type of content, in order to test it out - *"play around for a while"*. ***Methodological findings:*** Here, task analysis is less guiding as a method. In order to guide users to the different value-adding features it could be fruitful, but the users given the opportunity to get free surf in the evaluation found these features themselves and 'played around' by themselves. However, note here that some of the users explicitly said that they never explore this type of content on sites and that the tasks therefore not corresponded with how they would react on the site, given that they used it by themselves. The interviews gave feedback for the fact that this was appreciated.

3. ***The design - and technical related entertainment:*** This type overlaps the second point, as some of the technical features were used as support for more interactive stuff, as games and the remix for instance. However, there are non-interactive animations and likewise on the site as well, which could be put in this last category. Also, all the graphical design is suited to fit in this final category of entertainment.

Figure 4: The 'interactive zone' page

This type of entertainment also scored as a factor that amused the users. Spontanious comments during the 'think-aloud' as well as answers in the interview show that. It seemed natural to talk about *"the design"*, *"the form"*, *"the format"* and so on. However, it did not seem as a good idea to separate the static, i.e. the illustrations, the choice of colours and so on, from the moving characters, the animated texts and other type of multimedia features from eachother. When asked, users were quite clear that this was the same thing - *"the format seems modern, with the fonts, the colours and the moving stuff"*. This type of comment was quite common, and showed upon difficulties of separating the two. ***Methodological findings:*** Reaction of this type of entertainment was more common from those users tested by themselves. The ones working in pairs reacted on other type of features. Overall, more reflection on details was given by the single testers. Task analysis, in itself does not bring any results at all for this type of entertainment. However, the think-aloud protocol gives guidance. Users self-reflecting about moving features, typography, colours and more. It happend that someone asked *"could I interrupt my activity with the task for a while, I would like to explore this feature"*. The tasks disturbed the exploration of this type of entertainment. The interviews, however, gave numerous results in discussions around this category. Intervention from tester is not to recommend, as for the risk of influence.

Conclusions

In our empirical tests we identified three categories of entertainment on the web site *Eurovision Song Contest*.
First, *Contest related content,* like all the top lists of the winners during the years and so on. This was a category amusing the users scoring high on the interest rate of the contest. Second, *value-adding content,* as interactive quizzes, downloadable screen-savers and possibility to mix your own song. This was a type that many of the users mentioned that they usually searches for in this type of sites. Third, and last the *category design - and technical related entertainment*. Examples here are typography, choice of colors and animations of different kinds. Here, no specific user group were spotted. However, it was obvious to the testers that single user tests were more suitable in order to get feedback on the last category. For the first, the *contest related content* task analysis worked fine, which was not true for the second, the value-adding content. Here, users sometimes wanted to interrupt their performance of tasks to explore specific features. Even if it was explicitly allowed, users seemed a bit worried, when interrupting

tasks. Finally, intervention from the testers could be suitable in some of the cases, otherwise it may seem peculiar as a user to explore and being entertained totally alone with someone watching silently with a notepad.

Overall, a great situatedness in tests of this type of web sites seems very clear. The type of test person, elaboration with interview questions and more is important. The users are overall less objectified in testing entertainment web sites compared to traditional usability testing.

Future work - progress in the project

The project *Joyride!* continues with completion of the first iteration as well as the performance of the rest of the 180 tests. This study of *Eurovision Song Contest* gave some guidance but also, as always, enlightened some questions: How about the interventions - *are* they really necessary in some circumstances? What should we do to overlap the gap when task analysis is not suitable any more? Is 'free surf' really the proper solution to that? Are these categories of entertainment general - or will we find more categories further on? Hopefully, future tests will bring us closer to some of the answers of these questions.

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RoamWare: Towards Seamless Ongoing Interaction across Mobile Meetings and Dispersed Settings by Use of Internet Technology and Multiple Mobile Devices

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Abstract: This paper explores how a combination of Internet technology and multiple mobile devices could be used to enable seamless ongoing interaction across mobile meetings and dispersed settings. Theoretically the paper explores session management models for sustained interaction. As a result of the exploration the RoamWare system is developed. The implementation of RoamWare contributes to the field of HCI and CSCW by illustrating how session management models can be modified to incorporate spontaneous mobile meetings into ongoing sessions of interaction.

Key words
Interaction histories, Mobile meetings, Mobile CSCW, Ongoing interaction, Session management.

Introduction
The vision of mobile technology has sometimes been formulated as support for "anytime, anywhere" work. However, an empirical study of mobile work (Wiberg & Ljungberg, 2001) showed that hardly any mobile work takes places "anytime, anywhere". Rather, time and place is critical to the work and traveling thus becomes necessary. A more appropriate formulation might be to talk about "particular time, particular place" support.

On the contrary, "anytime, anywhere" work is possible with use of the Internet. People from different parts of the world can collaborate and access information from anywhere, at anytime. Thus, particular time, particular place work, e.g. "mobile meetings" (Bergqvist, et al, 1999) can be supported with anytime, anywhere technology, e.g. the Internet. According to set theory that can be modeled as follows:

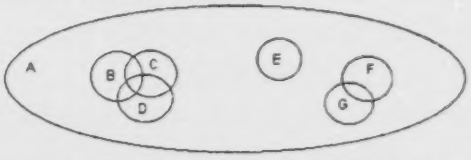

Figure 1. A model of Internet as support for "anytime, anywhere" work (set A) and mobile support at specific places at specific times (i.e. set BCD,E,FG). The intersections between B,C, D and F,G indicates that the workers are geographically co-located in mobile meetings.

However, even though there has been a lot of support developed for stationary work and formal meetings there has been little work done to support spontaneous and ad hoc meetings, i.e. mobile meetings. In this paper we have explored how a combination of Internet and mobile technology could be used to enable *seamless ongoing interaction* for mobile CSCW (Computer Supported Cooperative Work) across "mobile meetings" (Bergqvist, et al, 1999) and dispersed settings. The issue of *seamlessness* is an important element within the CSCW research area. Ishii and Miyake (1991) defines it as an *unobtrusive integration of any noticeable system aspect into the surrounding context* and Borghoff and Schlichter (2000, p. 127) distinguish between several types of seamlessness (i.e. communication media, working mode, phases of the group process, technology, and time). Enabling seamless ongoing interaction includes how to dynamically manage who is part of the interaction over time. Thus, a theoretical contribution offered in this paper concerns *sustained and dynamic session management*. Generally, Session management (i.e. the technical management of sessions) within CSCW refers to the process of starting, stopping, joining, leaving, and browsing collaborative situations (Edwards, 1994). Thus, session management models are critical to all CSCW systems. However, one assumption made in current implementations of session management models in CSCW systems is that sessions are clearly separated and established without previous interaction. However, Kristoffersen & Ljungberg (1999) has challenges this assumption, arguing that in real life: "*Establishing*

interaction always involves interaction. Interaction often interrupts, or replaces interaction. This is done in an unproblematic, effortless and effective way". Still, current implementations of session management models force someone to do a significant amount of overhead work to set up a new session (Edwards, 1994).

This paper presents RoamWare, a CSCW system that illustrates how Internet technology and multiple mobile devices can be used to support seamless ongoing interaction across co-located mobile face-to-face meetings and dispersed work settings.

Towards Seamless Ongoing Interaction

There are a lot of both technical and social aspects to consider for enabling ongoing interaction for mobile CSCW. Therefore we have developed the model below (Wiberg, 2001) (figure 2) to illustrate a set of scenarios that allows us to theoretically explore the possibilities for and limitations of ongoing interaction on both a technical and social level of analysis. Again, set theory is used to illustrate four co-located mobile meetings (A, B, C, D) taking place at different places over time. Each set contains a couple of elements (i.e. persons) and the arrow denotes that a person participates in these meetings in various ways over time. See figure 2.

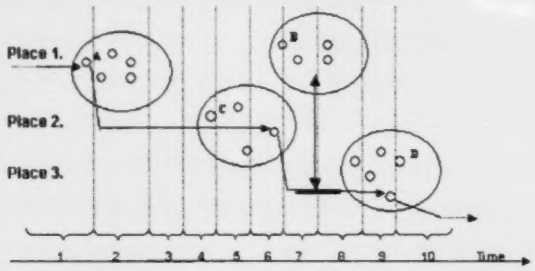

Figure 2. Possible combinations of mobile meetings with face-to-face and remote interaction

The model above illustrates a set of mobile meetings (A, B, C, and D) that happens at different particular places over time. The inner circles, or elements of the sets represent individuals participating in these meetings. Along the time line a set of numbers and lines has been set to point out some critical phases (1-10) of mobility and ongoing interaction due to the larger work context. In the model the things happening for a particular individual within a mobile meeting circle is viewed as that particular persons co-located setting, whereas everything else happening is viewed as dispersed settings. According to this, remote colleagues who also might have their own mobile meeting are, from the individuals' viewpoint, dispersed. As figure 2 above illustrates a person enters a mobile meeting physically in phase 1. In phase 2 the person leaves the meeting. However, by use of Internet technology he/she can still follow the meeting remotely through an appropriate interaction channel (e.g. voice, video, etc). In phase 4 the person in focus enters a new meeting. Meanwhile the meeting continues a new remote meeting is established (phase 6). Of course, the person could remotely participate in that meeting as well. However, on a social level that would imply that the interaction focus would be on the remote interaction instead of the surrounding face-to-face interaction. Thus, if that is not appropriate on a social level the interaction filter should be configured to not allow seamless establishment of remote collaboration with another meeting during a present meeting. Another alternative is to link these two meetings together to establish a larger meeting with remote participants for each physical setting. When leaving the current meeting (phase 7) a filter could be set to scan for remote meetings held within a specified work group as to allow for remote collaboration. Still, on a social level, face-to-face interaction is typically prioritized so, if another face-to-face meeting starts (phase 8), the user should have the opportunity to leave the remote interaction and, by doing that also distribute a notification to the remote participants about the exit from the meeting. In this way, seamless interaction across physical and virtual meetings could be handled in the same ways as entering and leaving of chat rooms typically represented as: "Person X enters the room", "Person X leaves the room". This seamless integration of the physical meetings into the virtual interaction could also offer similar functionality as chat rooms (e.g. the possibility the brows the groups interaction history). In this case this functionality could also include face-to-face interaction between some of the participants, remote colleagues, note takings of interest to the rest of the group, etc.

Requirements and scope

Today we have several technologies for communicating over the internet (e.g. email, IP-telephony, chat, etc). The scope of this paper is therefore not focused on the channel of interaction. Rather, the focus is on how to dynamically manage and maintain the interaction across mobile meetings and computer mediated interaction.
As figure 2 illustrates we need to be able to automatically address the participants in each meeting to be able to sustain the interaction after having left the setting (as the case of phase 2,7,and 10 in figure 2). Further, when having determined who to include in the session we need to connect the participants to an interaction channel for the continuum of the interaction (e.g. email). Finally, we must provide the user with support to find out which active sessions that exist within a group (e.g. search and browsing support of different sessions).

Implementation

Based on the requirements above a prototype system called RoamWare was developed. The name "RoamWare" refers to GroupWare for roaming or mobile groups. In the current implementation RoamWare provides mobile support for laptop computers. The PC client part of the system has been implemented on a couple of IBM 600 laptop PCs and a Libretto subnote PC, which has built-in infrared ports. The PC client runs on top of Windows 98 and uses Windows own drivers for IR-communication. However, to just be recorded by the other participants during a physical meeting almost any IR-equipped device can be used. In this project a wide variety of devices where used for this purpose (e.g. a Nokia 6150, a 3com Palm IIIx and Palm V, a Libretto subnote PC and a Psion 5mx). Further, each computer runs a web server and is always connected to the Internet over a 3com WLAN. The next section gives a more detailed description of the three subsystems RoamList, Roamweb and RoamLines.

RoamList: Making it possible to reestablish interaction over the internet after a co-located meeting

While being in a meeting the laptop computer scans the close vicinity of the user for other co-located devices. The system uses IR to automatically detect the participants within proximity (i.e. a few meters). For every identified device the ID number collected is used to associate a handheld device (such as another laptop, a PDA, etc) with the name and email address of its owner. If an unknown device is detected the system provides the user with the opportunity to add that device to the interaction history by typing in a name and his/her email address. The system only adds people to the list when the list indicates that a meeting is in progress. This avoids that unwanted persons are added to the interaction history even if no interaction has taken place (like passing someone in the hallway, which also has the system running). The name is added to the interaction history list with a pointer to the correct email address. See figure 1 below:

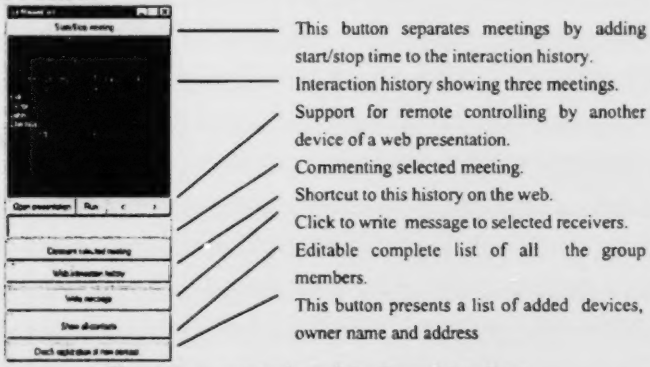
This button separates meetings by adding start/stop time to the interaction history.
Interaction history showing three meetings.
Support for remote controlling by another device of a web presentation.
Commenting selected meeting.
Shortcut to this history on the web.
Click to write message to selected receivers.
Editable complete list of all the group members.
This button presents a list of added devices, owner name and address

Figure 1. A screenshot of the RoamList client.

Connecting the participants to an interaction channel: As seen in figure 1 above a meeting can be selected to send a group message with email to all participants of a certain meeting. A meeting can also be *inverted* so that a message can be passed to everyone in the group that did *not* attend a certain meeting. Of course, participants can also be selected from different meetings as well as from the list of the whole group (See the 'Show all contacts' button in figure 1 above). RoamList also have some extra features to support meetings held in ordinary meeting rooms, i.e. a participant can connect a laptop running RoamList to a projector and then control a slide show presentation with any device (i.e. change slides) supporting the IrDA-standard (such as a Nokia mobile phone, or a Palm Pilot) by just pointing his/her IR-device towards the laptop.

RoamWeb: Showing other group members on the Internet that a meeting is taking place
For dispersed group members the RoamWeb system provides mobile groups with meeting information by automatically reflecting interaction his tories generated by the RoamWare system on the web. Figure 2 below show a web mirror of a personal interaction history as generated by a RoamList client:

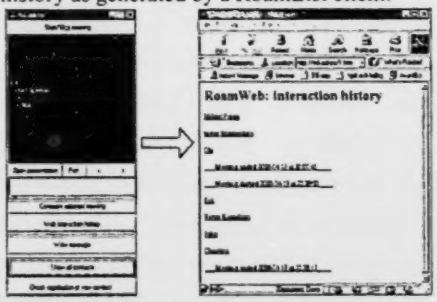

Figure 2. Public mirror of interaction history.

The interaction history published on the web is an exact HTML copy of each client's interaction history list. The web interaction history can provide synchronous as well as asynchronous information to other group members. As soon as a person takes a note and his/her client is set to "public" mode it automatically reflects the content to the web. A dispersed person can then easily follow the meeting over the web and see notes taken, issues discussed and persons joining the meeting. The content is automatically updated through the "meta http-equiv refresh" HTML tag that reloads the web page continuously. The names of the participants on the list are 'Mailto:'-links so that contact can easily be established. Of course the publishing of the list is optional as not to conflict with integrity aspects of the work. In the same way *roles* can be customized for web publishing, e.g. group leaders, secretaries, etc. In that way group members can virtually follow notes taken during physically face-to-face meetings and follow who has attended (or are currently attending) a certain meeting. At the RoamWeb web site, navigation of all group members interaction histories are provided on a single web page making it possible for a user to get an overview of all current and past activities of the group by just a glance at the site. See figure 3 below:

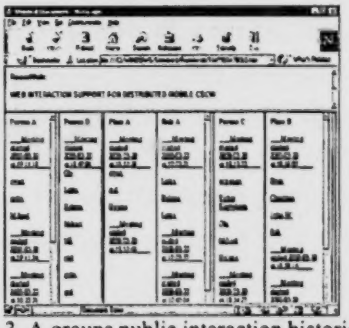

Figure 3. A groups public interaction histories

RoamLines: Support for overviews of threaded meetings
Finally, the RoamWare system also contains the RoamLines subsystem. RoamLines provides the group members with visualizations of different threads of interaction among the members of the mobile group. RoamLines supports querying to the system about topics such as "who has been to which meeting?, who was absent?, who has discussed a specific topic (possible to see if notes about the meeting has been added in the RoamList system), etc. The queries are made of basic Boolean expressions such as "and", "or", "not". The results of the queries are graphically visualized as threads of chronologically ordered meetings where each meeting has boxes with meeting attributes attached to it (such as participants, time, date, notes, etc). Figure 4 below shows an example of such a thread:

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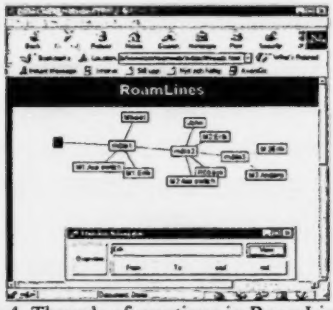

Figure 4. Threads of meetings in RoamLines.

As seen in figure 4 above, a query has been made about in which meetings "Erik" as participated. The query is stated in the Threads Navigator and the result is presented above. The meetings are chronologically ordered over time starting at the red box 'X' which is the current time. As seen in the visualization Erik has been to three meetings. The nearest one in time was together with "Mikael" and the topic was about an "Axe Switch".

RoamLines uses the rubber band technique (Sarkar et al, 1993) to graphically separate the items in space and connect the meeting objects and attributes chronologically. This technique gives the visualization the dynamic needed to represent different threads of interaction evolving through personal face-to-face interaction over time. This technique also provides the user with support for arranging the threads in any way they want to very direct.

Discussion

So far RoamWare does not support identification of dispersed participants so that they are added to the interaction history. Rather, that is handled by additional applications for that collaboration (e.g. email systems, ICQ, shared work spaces, chat rooms, etc). Further, in this version RoamWare only monitors that people are joining meetings and not how long they are staying or when they are leaving. To really make this transparent we have considered short-range radio (e.g. bluetooth technology) as an alternative. With RoamWeb and RoamLines, RoamWare provides its dispersed users with support for following a certain meeting from a remote location. Since a meeting can be followed based on a topic or constellation of people instead of just related to a person or a place it makes it easy to maintain the interaction even if the situation changes (e.g. if someone has to leave). Today all "incoming interaction" to a co-located meeting is handled through other technologies (e.g. email systems, mobile phones, chat rooms, etc). However, in future versions of RoamWare we plan to include this into the interaction histories as well.

Related work

There have been several attempts to support mobile collaboration at physical meetings with multiple PDAs. However, all of them are focusing on using the devices *during* a meeting instead of using the ad hoc setup of multiple co-located PDAs as a lightweight way to provide meeting support to co-located and dispersed group members both during and after meetings. Myers et al (1998) for example, use a set of multiple PDAs (3com Palm pilots) connected to a PC. However, their research focuses on how to use these devices *during* meetings rather then as *bridges between* physical face-to-face and virtual meetings. Another attempt is the NotePals system (Davis et al, 1999). NotePals is a collaboration tool that runs on several PDAs (3com Palm Pilots). However, this system supports sharing of notes on the Web taken on PDAs *during* a meeting rather then using the PDAs as *bridging devices* for later physical or virtual meetings. There have also been attempts to use small devices for *user monitoring*, e.g., Active Badges (Want et al, 1992) that support location tracking and Hummingbirds (Holmqvist et al, 1999) that support groups with presence awareness. However, none of these uses information collected by the devices as *interaction histories*, which can be used later for re-establishing of interaction. Another prototype developed related to RoamWare is the "Forget-me-not" system (Lamming et al, 1994). "Forget-me-not" shares several requirements with RoamWare (e.g. sensing the user's environment and automatics data capture of location of events, people present during events and focus of the event). However, "Forget-me-not" was developed as a personal memory aid whereas RoamWare is developed for collaborative use. Concerning the RoamLines system there have been some attempts on using threads for information visualization. Gutwin & Greenberg (1998) uses threads to provide workspace awareness and Whittaker, et al. (1997) uses threads for visualizing lightweight interaction in the desktop. However, none of them has explored the use of threads for visualizing threads of ongoing, and mobile face-to-face interaction.

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Conclusion

This paper contributes to research on session management models for CSCW systems by illustrating the idea of *ongoing sessions of interaction* as an alternative to the taken for granted view of sessions as clearly separated from each other in time and place. Instead, as this paper suggests, sessions can be maintained and the choice to participate in them can be left to the group members. This contribution to support *ongoing* rather then *separated sessions of interaction* opens up new interesting areas of research concerning how to seamlessly integrate other interaction technologies as well into ongoing sessions of interaction across physical and virtual arenas (e.g. phone calls, video, etc). This view also opens up for new interesting questions concerning how to help users to easily choose between, and negotiate their participation in different threads of ongoing interaction. Finally, this paper has illustrated how Internet and mobile technology can be integrated to cross over particular places and dispersed "anywhere" settings. Future work includes user studies and evaluations of how RoamWare support and influences group collaboration.

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HTML To XML/XSL In 3 Not So Easy Steps - How The Open University Uses Content Management To Produce Websites

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Abstract: The Open University is a world leader in the use of computer conferencing and online services for education. This paper discusses the problems we faced providing a large amount of quality material on-line in short timescales. It will discuss how we addressed these problems, by moving from developing sites on an ad-hoc basis in HTML, to holding our content as XML and using a content management system to deliver that content.

The Background

In the early days of the production of websites for courses at the Open University, it was a small-scale affair, handled by 3-4 people, providing basic information to back up the material sent to students the "old-fashioned" way; on paper. It included the odd news item, possibly some errata and maybe a course calendar. The information provided on the website didn't change very much throughout the course duration and the design of the website was not of very high importance.

Three years later we have 180,000 students with the facility to use our online services. There are 10,000 students using the Internet as the only method of teaching on the current presentation of our flagship, online course "You, Your Computer and the Net". By the end of 2002 we intend that all our courses will have a significant on-line presence.

Why HTML Became a problem

Initially web sites were created in HTML using web-authoring packages. Each website was built individually, some with the assistance of a professional designer, some without and occasionally an editor might get involved. The content would be provided by a member of a course team and edited into the site by a web developer who was not directly involved with the course.

As the web started to become more available in peoples homes, more course teams wanted to build more websites holding more data. The sites started to change from being just a convenient place to hold updates and information that didn't make the mailing of the printed course material, to being a way of delivering the course material in its own right. The workflow changed from 1 person developing, editing and maintaining each website, to being the work of a whole project team. People involved with creating each site now included

- Course team; Academics who authored the content
- Graphical designers
- Editors
- Quality Assurance testers
- Web Developers and programmers

A site needed to go through the following basic stages

- Authoring and editing of the content
- Design of the site both in terms of the look and feel, and the site navigation
- Putting the content into the site design
- *Re-editing*
- Quality Assurance and testing

And of course in reality no one stage would be complete before the next started. Both content creation and site design needed to be able to happen in parallel. We also faced the problem that content authors and editors would not necessarily have; or want to develop; the skills needed to edit a web page. Something needed to be done to make this production easier, and the obvious solutions was

Separate the content and the design

The first forays into tagging our data

We initially started using programming techniques in ASP and ColdFusion to update and extract information from relational databases, this worked in principle, but proved problematical as our webservers ran on several different platforms. This meant that systems were not very portable, and restricted our choice of the best place to host a site.

The database approach started us thinking about the structure of the content of a site and the best way to define that structure and hold the structured data. We decided to use ColdFusion as this would give us an approach that could work across more than one operating system. To hold our content we used ColdFusion data-structures.

For example: To build a site displaying news items, we would first define a news item and say it consisted of
1. A date
2. An Author
3. The article itself

The website was built to include a ColdFusion data structure consisting of these elements.

Next this was expanded to allow a data structure to contain another data structure

For example, the basic news item, could be expanded so that the article is defined as
1. Title
2. Article Content.

The structure of the data could now be nested, and built into a tree structure.

The information in the data-structures was written to , and read from a flat-file database on the web server. To enter the information into the "database" a web-form front end was created in HTML and user a web browser, the content was typed into the form, then written via the data-structures to the "database". When the web-page was requested, the "database" was read into the structures, and the HTML page generated and presented to the browser.

We had a way of allowing non-skilled people to input and edit data using the web-form front end. The system also allowed us to tweak the design, "behind the scenes" while the content was being input because the content was separated from the design.

The key step forward at this stage was that we were completely defining the way the content in our web pages was structured. We would say that a news item had to consist of a date, an author and an article. That an article had to consist of a title and one or more paragraphs . However the most important lesson learnt was that although we could alter the look and feel of the site throughout its development, colors could change, positioning could be altered, the basic navigation, had to be defined right at the start, and once decided,

changing it would be very difficult. For a simplistic example, our news website could consist of an index page listing the titles of the news items, which were also links to pages with the news items themselves. We could change how these links were arranged on the page, but deciding to change the navigation so that news items were listed by date, would be much more fundamental and involve much more work to implement.

So why did this not work?

The basic idea was a sound one, defining and nesting data structures and keeping design and content separate, but we found 3 major problems with this method.

The first problem was that the web pages were being generated dynamically each time the page was requested, all data was read into the data-structures and dynamic storage, and then the page was rendered for the browser. This was very slow and also unnecessary because although content could change, it was not changing frequently, so there was little benefit to be gained from the dynamic nature of the system

The second problem was that each website that was created had to be programmed separately requiring an experienced ColdFusion programmer. The forms used as the interface to enter content had to be created manually and the code to access the data structures built in. This was slow and time-consuming, and we needed to turn round websites much faster than we could program them. It also meant that each system built by each programmer was slightly different, making maintenance more difficult.

The third problem , and the final nail in the coffin for this particular system , we started to get requests for static versions of the sites that students could use offline to save on telephone costs. With a dynamic site this was difficult and meant that the site needed to be "grabbed" each time.

We needed a solution that was

- Easy to use for every course website, a basic system that would work for any site
- It needed to be platform independent
- It had to allow non-skilled people to input content
- Changes to the design and changes to the content had to be able to happen simultaneously.
- It had to perform well
- And it needed to produce html pages that could be run off-line

Developing our own in-house content management system.

At this stage the idea to use XML came up, initially in an attempt to make the earlier systems perform better. It seemed clear that this was the way forward, we could keep our data in an organised format that we could use for other purposes. We are called the Open University, which means we must build websites that are open to all. This has often meant building a site that was a compromise between an interesting design and the best site for full accessibility. XML seemed to offer us the nirvana of generating several different sites that would be the best for each target audience, and also allow us to produce sites for WAP, WIDs, WEBTV and anything else we could think of starting with a W.

The first requirement was for a system that could be used for each website that needed to be built. In the original system the web forms used to input the data were coded manually. We wanted a way that input forms could be generated automatically. The obvious way to do this was to strictly define the structure of all the content that would be needed and use this as the basis to build the input form. This naturally led us to use first DTDs and then XML schemas. We produced a system that would read an XML schema and generate a web page with a form that would only allow the user to enter the content as it was described in the schema.

Having allowed the user to enter the content, a way was needed to manage that content. We went back to looking at the structure of our content and the site layout, and developed an object-orientated approach. Content in a web site is split into objects . These objects might be pages , or parts of pages

For example: My Mission is to build a web site for a course on "Chocolate and its role in society" . The course will be taught in 3 sections.

The first thing I need to do is to take a traditional story-boarding approach and decide what information will be on that site, and roughly how the navigation will work. Once I have done that I can divide the site into objects.

I create an XML schema to describe the content for each object. So in the example above I have three objects

- The Banner at the top of each page, containing the Course title
- The front page of the site with links to each module
- A section page

By breaking the site up into these objects we could easily control how the XML content was used, and who could update it. Each object also had programs, or methods, associated with it, which had the actual job of turning XML into web pages. To generate that HTML we used Cold Fusion programs , XSL and the APACHE XML/XSL parser. Some methods came as standard with the system, but it was flexible enough to allow the programmer to add their own, for example, a method might be adapted to add the date that the page was generated to the bottom of each web page, or to display the data from the XML associated with other objects , such as the course title, avoiding the need to duplicate content.

Each object was clearly defined and had associated with it

- XML schema
- XML data
- System methods
- Project methods
- XSL

But did the system address each of the requirements above?

1. **A basic system that would work for any site**

   By using the XML schema as the basis of the site, and generating the input forms from the schema, the system was much more generic and easily adaptable to creating a range of sites. The input forms were automatically created removing the need to individually program them for each site.

2. **It had to allow non-skilled people to input content**

   By using the web form to input the information, anyone who could use a web browser could enter or edit the data in the pages. This cut down training times significantly because people only had be shown how the form worked and not how to use a commercial web-editing package.

3. **Changes to the design and changes to the content had to be able to happen simultaneously**

   Because content and presentation have been separated, editors could edit, and designers could design. Changes to the design were quietly added to the stylesheet or XSL.

4. **It had to perform well**

   Presenting web pages generated dynamically on demand was a performance overhead we did not need. The system was built so that the end result was static web pages. These web pages only used the minimum amount of server side processing, and could be straight HTML if needed. Pages were only generated when the content changed. This system also allowed the content author/editor to preview the pages as content was entered, only publishing the page when happy with the end result.

5. **It needed to be platform independent**

   By generating static web pages as HTML rather than holding the information in a database and dynamically

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generating the pages, we could move the site to any web server with minimal problems. This had the added bonus that we could also move the web pages onto a CD that could be distributed to students for off-line browsing, cutting down on their overheads.

6. **And it needed to produce html pages**

   And so it can!

At this point we thought we had reached the end of the line, a simple system that anyone could use. Unfortunately we had forgotten one important thing, our key content providers, and they didn't like it. They were used to authoring in word. The web form had serious drawbacks from their point of view. Although were trying to separate our content and presentation, they wanted to be able to slot little bits of their own into the page, such as bold or italic. And what about bullet points or in-line links. We could make the web form take in the content , but it wasn't a "natural" way to write it.

Developing our own in-house content management system – Part 2

The basic idea worked, but the way of inputting the data needed a rethink. The method of using a web form to input the data was shelved, and a new Java application, or tool, was developed. It incorporated a more sophisticated permissions system, allowing us to define users, and what they could access. The tool consisted of 2 key parts, a site explorer and a document editing tool.

The site explorer allowed the content editors to manage their objects and the content they entered more easily, they could preview , publish or delete web pages and see what had been entered when.

The editing tool allowed editors and authors to include simple formatting such as bold , italic and bullet points, as well as more easily add basic web items such as links to other pages, it even allowed authors to include tables, and it has a more word –like look and feel.

As sites started to make use of the editing tool, further features were added so that custom Java applets written in-house could be included in a page.

Had we got there?

Unfortunately not. The new improved system still had some disadvantages. The system managed web sites well, but its success was also its downfall. When it was sold as an idea people were very enthusiastic, we were handing them back control over their sites and their content, and so the demand for such sites was high. Although all sites were initially set up in the same way, and once set up the system was relatively easy to use, that initial setup was still cumbersome and complicated to get right. Many frustrating hours could be spent trying to persuade the site explorer to reveal its secrets. We had concentrated on the editing interface for our users, and quite rightly so, but there were not sufficient programmer-hours to make that initial set up easier and smoother for our web developers. The time had come to accept that 1 programmer , who was working on several projects at the same time, could not produce the kind of software that entire companies have teams of programmers working on all the time, and so the decision was made to buy a commercial system.

What next?

Having chosen and started to use our commercial content management system, we are now turning our sights to a wider field. We want to develop an XML schema that will apply to all course content, web, print, audio, video and use this as the basis of all content production. We are in the process of seeing if this is a practical proposition, is there such a thing as one structure that will fit all courses? Maybe I'll be able to tell you at WebNet 2002

Promoting a Constructive Template for a Large University Web Site: The University of Vermont MagicScript Project

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Abstract: A large university Web site is a tool, an application utilized by a broad base of users with various purposes and goals. By employing a common interface such as a constructive template, a university can generate a standard graphic and navigational design throughout its Web site. We demonstrate how, by using a dynamic template that is composed of centrally located graphic and layout components integrated by scripts, we are able to achieve uniformity while allowing for varying degrees of creative freedom from Web site developers. Our template structure also can extract institutional content from central databases of personnel, calendar, news, and course information. We also will discuss how the template structure has an impact on Web support in a large campus environment.

Introduction

The University of Vermont (UVM) published its first Web content in November 1993. In subsequent years, the number of HTML documents has grown to more than 80,000 Web pages created by users with a broad range of skill levels using a variety of tools and computing platforms. In the summer of 1998, the university made a concerted effort to address the issues of organizing the existing content and develop a consistent page layout and navigational structure. Just a few months earlier, Norsk Regnesentral, the Norwegian Computing Center, had begun developing its constructive template to address similar issues on its Web site (Østerby and Larsen, 1999).

To promote some level of design continuity at UVM, an archive of graphics and an official university logo previously had been made available to campus Web site developers. However, the use of common graphics alone only tacitly addressed the design issue and did not provide a solution for a uniform navigational structure.

The constructive template which emerged from the 1998 effort provided common design elements and a navigational framework that could be manually laid out by the Web site developer or dynamically generated by directory content. We chose to leverage existing tools in the university's main UNIX servers, Apache Web server, PHP, and mySQL to develop the template.

Since its implementation, the template has undergone one major revision (in 2000) and countless minor revisions. Template users' sub-sites successfully reflected the new template design and navigation.

Goals

On the technical front, the template project is compatible with existing university hardware and network infrastructure. Additional requirements include the ability to remain compatible with common Web-editing applications, to meet accessibility standards as established by the Web Accessibility Initiative (WAI) of the W3C, to be available to any university constituent and to provide varying degrees of customization for Web site developers.

The methodology for developing the template follows the Object-Oriented Hypermedia Design Method's (OOHDM) four steps: conceptualize the data underpinning the Web site; develop a navigational structure for layering content; design an interface appearance and behavior; and map the data to the design. This type of model provides a better understanding of the design and perpetuates clear documentation (Lowe, 1999).

Strategy

The strategy we chose to pursue involved the use of a constructive template. This strategy is cost-efficient in its reuse of navigational and graphic design. It relies on the separation of the document's contents from its presentation. The presentation can be altered centrally without compromising the embedded data. This is an object-oriented approach and offers more flexibility over a cloning approach that does not allow automation of design adjustments and improvements. When implemented, the constructive template benefits Web site production and life cycle and creates a modularity that can be ported to alternative design strategies (Nanard, Nanard and Kahn, 1998).

Implementation

The UVM template comes in many different styles. Template styles are, in most cases, determined automatically by what we dubbed the Magic Script, or MagicScript. Templates also can be manually selected by using a subcommand in the configuration file.

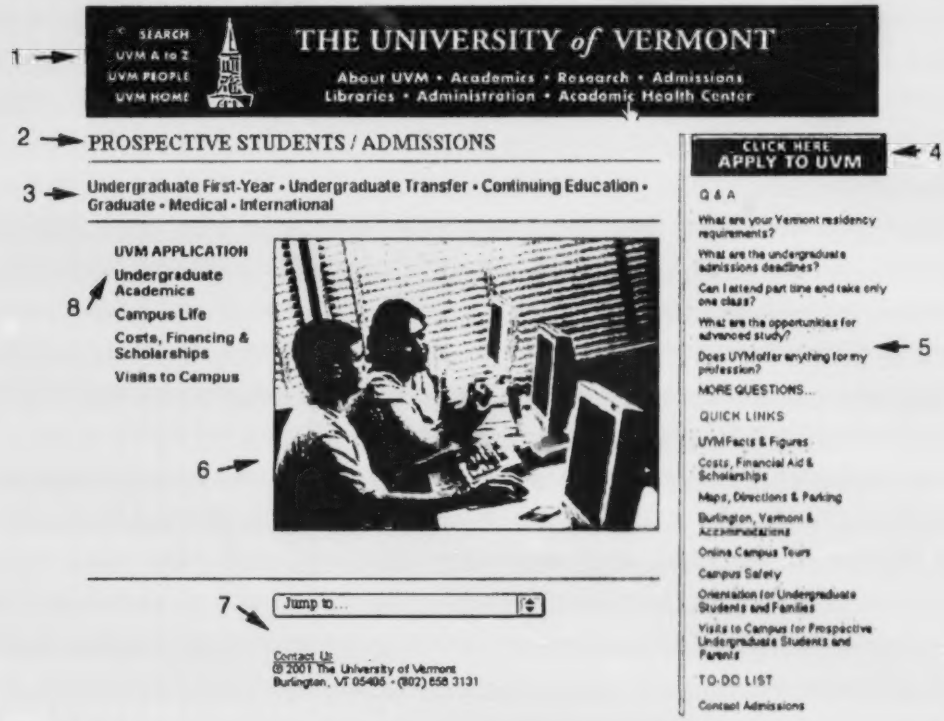

Figure 1: Constructive Template in action

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Features

1. UVM Banner (top)
2. Page Title (below Banner)
3. Main Menu type (below Page Title, in blue)
4. Optional Graphic (above Quick Links)
5. Optional Quick Links, et al (on right of page)
6. Content (below Main Menu type)
7. Jump Menu and Contact Info (bottom)
8. Optional Sub-Menu

The Main Menu represents the primary organizational hierarchy of the site. The Sub-Menus are used to expand Main Menu topics. "Quick Links" consists of several possible sub-items: Quick Links, News and Events, a To-Do List , a Q&A and/or Current Topics. These are designed to help expose important items on this sub-site that might be otherwise buried in the hierarchy. (Other campus sub-sites and off-campus sites might also be included in "Quick Links.")

The MagicScript

The MagicScript was written using the PHP scripting language. PHP is an open source project, well integrated with the Apache Web server project. PHP provides a rich scripting environment. The PHP language interpreter is compiled as part of the Web server software; thus, the PHP scripts are parsed and processed directly by the Web server, resulting in fast execution. The MagicScript and its supporting code modules are installed on the university's centrally supported UNIX cluster, home to about half of the university's 80,000 Web pages.

We use a common PHP security feature, known as "SAFE MODE," on this UNIX cluster. This security feature necessitates that every user who wishes to employ the script must have a copy or clone of the script in their Web publishing directory. To use the MagicScript, content providers run a utility program that makes a copy of the magicscript.php3 file in their home Web publishing directory.

The clone script is rather bare bones: The code consists solely of a few "include" directives that suck up the real script code from elsewhere on the cluster using HTTP protocol. Thus, SAFE MODE restrictions are satisfied and the university's Web Team can safely change the centrally controlled script sub-routines even though the "main program" clone is widely distributed.

The Menu Files

The MagicScript installation utility also creates two additional files that the user can then edit and deploy as they see fit. These files are named default.html and defaultmenu.html.

The defaultmenu.html file serves as the default Main Menu and overall site control file. The menu is defined by an HTML table, with three columns and as many rows as necessary.

0	Department Title Goes Here	email=department.email@uvm.edu,tc=short
1	Menu Item 1	page1.html
2	Menu Item 2	page2.html
3	Menu Item 3	page3.html

The first column represent the order in which the Menu Items will appear in the Main Menu of the Web page (except for Row 0, described below).

The second column represents the text labels that will be displayed as "Main Menu" choices for the Web site.

The third column represents the URLs associated with the labels in Column 2. The URL can be a simple HTML filename (e.g., page2.html), a complete URL (http://www.uvm.edu/wruv), or a keyword and string of additional script parameters that produce specialized content (See The Content Area).

Row 0 of defaultmenu.html has special meaning. Column 2 of Row 0 specifies the overall Page/Site Title. Column 3 allows the user to specify additional site parameters to the script, such as a contact e-mail address or a particular template style from our template library.

Additional menus, used as Sub-Menus or in special navigation areas, are constructed in an identical manner to defaultmenu.html, but without a Row 0.

Sub-Menus are identified to the script by passing the file name as a parameter (e.g., SM=submenu_name).

Items in the "Quick Links" area, (including Quick Links, Hot Topics, To-Do List) are generated by like-named files (quick_links.html, hot_topics.html, to-do_list.html). If these special menu files exist in the user's folder, they are automatically displayed. Similarly, if a file named "default1.jpeg" exists, it is used as the optional site graphic.

The Content Area

If the URL specified in Column 3 of a menu is a simple HTML file name, the script will use it to construct an anchor of the form

```
href="?Page=filename.html"
```

The file identified by script parameter Page is read by the script to fill the "Content Area" of the template. Some processing of the file is performed to generate page META information.

We have a growing list of keywords that can be used in lieu of a file name. These keywords, together with additional user supplied parameters, generate "institutional content" such as course listings or campus maps. This institutional content is drawn from various administrative databases maintained by central campus services. For example, an entry in column 3 such as

```
DIR&dept=Sch+of+Natural+Resources&type=F
```

will tap the campus Directory Server to produce a list of faculty in the School of Natural Resources, while

```
COURSE&category=FOR
```

will query our BANNER Student Information System to produce a listing of Forestry courses.

Automatic Mode

The site model provided by defaultmenu.html and some small collection of Sub-Menus is good for about three levels of site depth. Beyond that, additional folders and defaultmenu.html files may be required; however, for very large or frequently updated collections of content, the maintenance of all these menus becomes an issue. Moreover, information architecture literature suggests that "the foundation of almost all good information architectures is a well-designed hierarchy" (Rosenfeld and Morville, 1998).

The directory and file structure of the typical Web server enforces a rather strong natural hierarchy: Barring the use of file aliases, a particular file of content, or "content chunk," will exist in one and only one directory or folder.

Our MagicScript features a mode of operation that descends directory hierarchies and builds menus automatically. The script parses the folder in which it exists and indexes every HTML file and folder it finds there.

In each folder:

- If the script finds a file named .noauto, it skips the folder and moves on to the next.
- If it finds index.html, it reads index.html and looks for the document <TITLE>. It uses that title as the label for a Main Menu selection.
- If it finds another MagicScript, it reads the associated defaultmenu.html and looks for the sub-site <TITLE>. It uses that title as the label for a Main Menu selection. The link is constructed to invoke the found MagicScript.
- If it finds neither index.html nor a MagicScript, it uses the folder name as a Main Menu selection

For each HTML file, it reads the file and looks for the document <TITLE>. It uses that title as a Sub-Menu label.

Each Main Menu and Sub-Menu link is constructed such that the MagicScript again is invoked to display the selected file or folder.

When asked to display a folder, the script behaves as above, again displaying enclosed folder titles as Main Menu links. A link to the enclosing folder also is added. If there are no enclosed folders to display as Main Menu items, the Main Menu items don't change.

When asked to display a page, the menus remain intact and the page is displayed in the Content Area.

The navigation always reflects the current state of the document space; thus, careful attention needs to be paid to organization. Because the menus always display document Titles as links, careful attention must also be paid to document Titles. Document file names are mostly unimportant. Updating the Web site simply requires the content provider to add, delete, or edit the content files; navigation takes care of itself.

The script also recognizes JPEG or RealNetworks RealMedia files within a folder. For each it finds, it attempts to extract internal file descriptors (Title, Credits, Copyright, etc.) to use as menu labels. In the case of JPEG images, small-image thumbnails are built automatically and added to the menu. Clicking on the label (or thumbnail) displays the full-size image or movie.

Future Work

Our current system is loosely tied to our Oracle-based SCT-BANNER Student Information system via CGI-BIN-style PERL scripts. As we write this paper, we are converting these to PHP4 with Oracle support.

Our current campus directory server is ph/CSO. We are migrating this to LDAP, after which we will rewrite our directory server hooks to use native PHP LDAP support.

Using the Steltor CorporateTime calendar server, UVM has increased standardization of campuswide calendar services. Currently, and again using CGI-BIN, we can access our calendar database. We hope to streamline this using the PHP MCAL libraries.

Slowly, as we consolidate these elements, we hope to have a fully integrated "campus portal" incorporating calendar, course, and personnel database information.

Examples

- http://www.uvm.edu/
- http://www.uvm.edu/~plantbio
- http://www.uvm.edu/video/realserver/videos/
- http://www.uvm.edu/skivt-l/

Conclusion

Since its inception, the MagicScript methodology has achieved wide acceptance at UVM. Use of a common methodology has allowed the UVM Web Team to concentrate its support efforts on developing, promoting, and teaching the MagicScript. It also has saved time and resources for our users -- the administrative assistants and work-study students who ultimately are the departmental Web site managers. They now have a common framework in which they can concentrate on the timely update of content rather than on the complexities of design and navigation. In addition, the constructive template provides continuity for departments that use student workers, whose shorter tenures otherwise might lead to site-maintenance issues. Overall, we have been able to build a community of users who are now beginning to support themselves.

The constructive template also has allowed rapid prototyping of new designs. This was proven during the summer of 2000, when our staff of three people revamped hundreds of pages at the top level of UVM's Web site, as well as 50 participating sub-sites, in less than four months. Most of our time was spent seeking approval from various audience groups on the redesign; implementation itself only took several weeks.

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A Qualitative Case Study of an Online Auction Site

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Abstract: This paper presents a qualitative case study on online auction site. The user interface is the main criteria for user-oriented evaluation. The framework of methodology and test findings is presented in the paper. Results from qualitative analysis provide a more complete picture for the development of online auction site. It can help the developer and design development of online auction site to improve their interface.

Introduction

The World Wide Web (WWW) has been recognized by industry and academia as the key driver toward electronic commerce. The WWW also has dramatically changed how people sell and buy goods (Hahn 2001). An online marketplace is a web application that acts as an intermediary between market participants (i.e., sellers and buyers). In this paper, we will take a case study on the online auction site. An online auction is a special type of online marketplace where resource allocation and prices are determined with an explicit set of rules based on bids from market participants. The growth of electronic commerce and business-to-business applications has created an unprecedented emphasis on knowing who our users are and designing usable applications. The quality of a commerce site is rooted on its usability, which usually results from the adoption of user-centered development and evaluation approaches (Fleming 1998, Hahn 2001, Nielsen 1999). Therefore, usability evaluation is a necessary and repeated step during the life cycle of a website. This approach "a basic human factors method" remains a successful technique for assuring a positive user experience (Smith et al. 2000). Extensive research's have been carried to evaluate and improve electronic commerce site. Dong and Martin (2000) had done iterative usage of customer satisfaction surveys with 72 participants. Most of the results were basically an overview of user satisfaction based on quantitative result. It would not be beneficial for the electronic commerce development team to improve on their site. Nielsen Norman Group's (2001) had provided a list of report for E-Commerce User Experience. Their reports were more useful for the shopping site. Smith, Bubb-Lewis and Suh (2000) have studied a portion of electronic commerce site with twelve subjects. Their study focused only on the Order Status screen. Hahn (2001) had carried out a case study on online auction. However his study only shown the elements of the auction design affect the dynamics within marketplace based on a single day activity. This is useful for designing auction site but not on improving auction site.

Qualitative Analysis and User-oriented Evaluation

In this study, we propose a framework for user-oriented evaluation based on quality analysis in order to improve the interface of online auction site. Qualitative analysis is collected through the verbal protocol (Ericsson & Simon 1985). The participants say out loud what they are thinking while they are carrying out a task or doing

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some problem solving. This is also known as think aloud protocol. It is extremely valuable to have the user describing in their own words what they are attempting to do or what they are confused about. This is very direct evidence of the mental model that the user has developed of the system. An observed user error indicates that there is a problem but it is often the user's own words that clarify why there is a problem. To test usability of commerce site a developer can adopt two kinds of methods: heuristic evaluation or user evaluation. *Heuristic evaluation* is based on a pool of experts that inspect and use a (part of a) website and identify usability problems that they assume will affect end users. With *user evaluation*, a sample of the user population of the website is selected and is asked to use (part of the) website and report things that they think did not work or are not appropriate. We have chosen the user-oriented evaluation due to the limited human factor experts in our institution. Nielsen (2000) shown that it is enough to test a design with five users to find the vast majority (usually 80%) of the usability problems. Therefore, the cost (in terms of time and effort) of this method is not particularly high, and it does improves the website quality and reduce the overall development cost. The purpose of this study is to examine the usability of online auction site from the user perspectives. The user interface is the main criteria to know what type of problems would be face by users using the online auction site. This paper will use the findings from the evaluation to illustrate issues of practice and methodology in the context of qualitative investigations in order to give a comprehensive understanding of the Internet user and online auction site.

Methodology

This section describes the method we performed to evaluate our existing prototype called WhatDevice Auction site. We suggest a framework that covered procedure to be undertaken, evaluation to be performed, processing test results and presentation of test results. WhatDevice Auction site (Fig. 1) was one portion of the electronic commerce portal module. It was a research-funded project by a local private company in Malaysia. This site was unique because it contained only mobile phone product and served for telecommunication community only. Fulfillment tracking process page is also provided for users to track down their goods and payments. Six participants were selected for the evaluation. They were paid in order to have good cooperation. A small usability lab was created and equipped with video recording. The evaluation was carried out on a desktop computer with Internet connection.

Figure 1: WhatDevice Auction Homepage.

Experimenter briefly explained the overall session to the participants. Each participant was given a quick tutorial on auction concept. Experimenter gave instructions to participants after they signed consent form. Then participants were asked to fill up the demographic form. After that, participants were basically allowed to explore WhatDevice on their own for ten minutes. Then, five tasks were given and they were required to use WhatDevice Auction site as their primary site. They were strictly prohibited to use other online auction sites. The five tasks given to them were:

a. Find an interesting item in the What Device site.
b. Search for the cheapest bid on Nokia 8290 hand phone in the What Device site.

c. Bid on the Nokia 8290 hand phone
d. Submit an item in the What Device site.
e. Complete the fulfillments.

The *Wizard of Oz* technique (Preece et al. 1996) was used to illustrate the fulfillment process. An experimenter was taken the opposite role of the buyer/seller in the online auction process. The participants interact with auction site, but instead of a piece of software simulating as a buyer/seller, an experimenter is sitting at another room bidding and submitting item to the real participants.

The participants were asked to think-aloud while solving each task given. Participants were also encouraged to voice any feature they like or any difficulties they were having while using the WhatDevice Auction site. These verbalizations and their actions were recorded and were later analyzed. In the end of the evaluation, participants were asked to comment on the WhatDevice Auction site. In particular, experimenter asked about the best things, worst things, and ideas for improvements.

Result

All participants are 25 years old and male. Three participants were students and others three were employed. Job titles of the participants included programmer analyst, quality assurance engineer and administrative assistant. One participant used English as primary language and five participants used other languages (i.e. Bahasa Malaysia and Chinese). All participants have more than two years Internet experience. Five participants were beginner in auction activity and one participant had auction experiences.

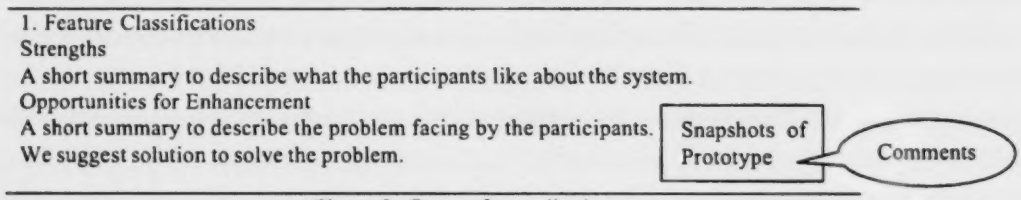
1. Feature Classifications
Strengths
A short summary to describe what the participants like about the system.
Opportunities for Enhancement
A short summary to describe the problem facing by the participants.
We suggest solution to solve the problem.
Snapshots of Prototype
Comments

Figure 2: Format for qualitative.

In this evaluation, we present purely qualitative data analyses. Seven sub-sections have been provided in this section that were search, browse, help, bid, submit item, fulfillment and other remarks. Figure 2 shows how we present our findings in a brief report for developer team. These findings can provide designers and developers with general guidelines for effective user interfaces for online auction site. Several quotes from verbal analysis are presented in the italic forms.

Browse

Browsing activity was the common activity when participants have nothing in their minds. Therefore, they would likely to use the category hierarchy.

Strength: Clear navigation and consistent layout would provide a better browsing for the participants. *"The overall presentation of the site is very good and I like it."*

Opportunities for enhancement: Participants complaint that the process of searching through a set of item pages was troublesome (Fig. 3). The site should provide a quick access to the third, fourth or last item page. *"Do I need to go through all these result one by one?"*

Search

All participants would use the search facility when they were asked to solve the second task. The target item to look for was known. They went to the search facility and typed in their keywords.

Strength: Search engine in the auction site provide a fast access to the known item. *"I think I will use the search engine because I know the model of the headphone."*

Opportunities for enhancement: Similar case for the browsing search result page (refer to discussion in *"browse"* above).

Help

Most of the beginner participants were using help when they were unable to submit their item. They would refer to the help page to find a suitable solution.

Strength: The help page was placed on the homepage and been highlighted on the top right screen. *"I'm new to auction sites. So I will look for help page."*

Opportunities for enhancement: Picture will provide clear message rather than reading a paragraph of text. However, the images should be more precise on what they're trying to tell (Fig. 4). *"What is this image? I usually do not read all these but the image tell me to go to main page."*

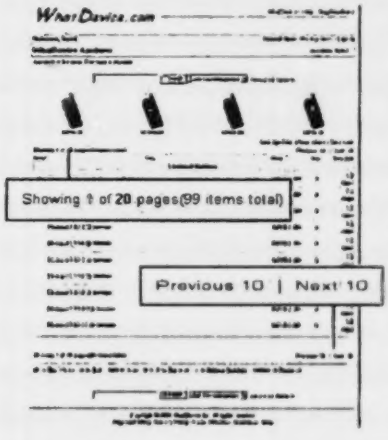

Figure 3: Browsing item page.

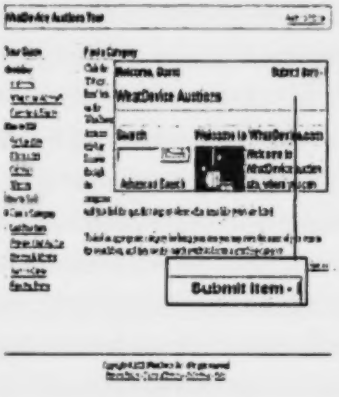

Figure 4: WhatDevice Auction Help Page.

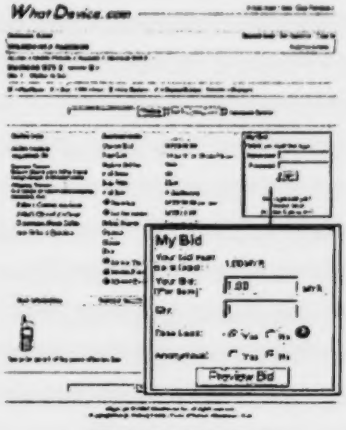

Figure 5: Item Page.

Bid

All participants were able to bid on the Nokia 8290. However, the WhatDevice Auction site should keep track where the participants had left and bring them to the appropriate page.

Strength: The bidding process was very clear because all the important details (seller info, auction info, and my bid) were on the top of the page (Fig. 5). *"I think I will bid on this item, so I will have to click on the preview bid button (refer to My Bid)."*

Opportunities for enhancement: Participants had to egister as a member before they can bid. After registered, they were brought to the other page (*my auction page*). *"Where is the item I want to bid just now?... Aiya, I have to search again?"*

Submit Item

All participants were successfully complete the submit item process. The participants had to follow instruction on several pages in order to submit an item.

Strength: Quick help were provided on the side of the form for the participants (Fig. 6). Participants did not have to guess some of the term used. *"What is the reserve price? Ohh... the minimum amount..."*

Opportunities for enhancement: Participants should be provided with choices whether they want to preview their information or just submit the form. *"I thought that the confirmation process is over...all those pop-up text box... then I got to the previewing page... then I have to click on the add item button... then finish my auction."*

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Fulfillment

The fulfillment process took a longer time because the participants had to wait for email notification.

Strength: The WhatDevice Auction site provided a *fulfillment tracking process page*. It will tell the participants the process of the good and the transaction. *"This is good for me to know where is my hand phone now and when the seller receive my money."*

Opportunities for enhancement: Email notification was not very informative (Fig. 7). Some of the email did not provide link to tracking page and participants did not have any ideas to solve the tasks. *"Then what should I do?"*

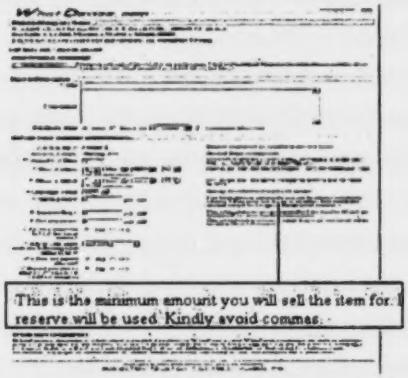

Figure 6: Submit Item Form.

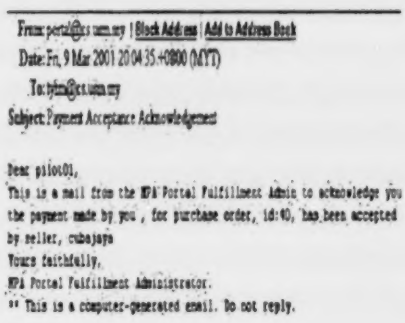
Date: Fri, 9 Mar 2001 20:04:35 +0800 (MYT)
Subject: Payment Acceptance Acknowledgement
Dear p1lot01,
This is a mail from the MPA Portal Fulfillment Admin to acknowledge you
the payment made by you , for purchase order, id:40, has been accepted
by seller, cubajaja
Yours faithfully,
MPA Portal Fulfillment Administrator.
** This is a computer-generated email. Do not reply.

Figure 7: Email Notification.

Other Remarks

Some of the participants brought up other issue as well. They were questioning on the membership issue and content management. This was some suggestion for the security and legal property of auction site. The best of WhatDevice Auction site was properly function and the overall interface was accepted in certain pages. The worst of WhatDevice Auction was to redesign the fulfillment notification and form confirmation in order to provide a better understanding. One participant suggested that the auction site could provide a *"my clipped items"* page. The participant could make decision after previewing and comparing all interested item. Some of them suggested that the presentations would be better in the pictorial format when browsing for an item.

Discussion

From the findings of the experiment, participants seem to be able to participate in the online auction activities less than three hour. They seem to be quite active and suggesting ideas on improving the WhatDevice Auction site. Feedback and comments from the participants were more valuable for the development of future auction site. This qualitative analysis has provided a better understanding of auction user and their activities on the auction site. In this way, user-oriented evaluation meshes closely with design and guides the design by providing user feedback. It uncovers usability problems that are not noticed during development process. This will helps to form an online auction site that will be usable as well as useful. These results were used to improve the next version of the online auction site (https://www.mpa.com.my/whatdevice/auction/index.jsp). This technique also enables developers with few resources (in terms of time or money) to benefit from user-oriented evaluation during development of online auction site. A positive side effect is that involving users in evaluation frequently increases user interest and acceptance of the proposed online auction site.

Based on the qualitative analysis, we proposed some recommendations for future online auction sites. The following are the recommendations for each section:

a. Browse - Auction site should provide two types of browsing activity. One is in text format and the other is picture format.

b. Search - Auction site should provide a better search result page so that users can easily access to any pages.

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c. Help - Auction site should provide a clear picture and instruction on the process of online auction especially for beginner.
d. Bid - Auction site should provide a fast bidding item procedure. Users should return to the page where they had left after register as a member.
e. Submit Item - Auction site should provide a clear instruction and fast submitting item procedure.
f. Fulfillment - Auction site should provide a clear notification and quick access to the related pages on the auction site.

Conclusion

The advantage of this study is that it provides promising results without having bias or personal judgment on the prototype. We can see the effectiveness and efficiency of online auction site from the real end-users evaluation. It provides feedback to maintain the good feature and suggestion on improving the current WhatDevice site. For future study, evaluation on other commerce sites like shopping and classified should be carried out. The evaluation and design of commerce site presents a great challenge to those developers who are engaged in the development and applications of Internet portal. Hopefully, our efforts will contribute to the creation of a society in which online auction site will serve to enhance user welfare.

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MOTIVATING FACULTY TO E-MBRACE E-LEARNING

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Abstract: Teaching and learning are still teaching and learning whether they are done in the classroom or online. Well developed online courses, applying good educational design methodologies, can enhance student learning and offer considerable opportunities for the students, the teachers and the institution.
Many tertiary teaching and learning institutions, to meet the increasingly diverse needs of their student body and their corporate initiatives and strategies, are being driven to embrace online teaching and learning. For many faculty there are barriers and concerns about delivering their courses "online", fear of failure, insecurity about change, lack of strategic planning, lack of support etc. It is not only essential that adequate upskilling and technological support is available for faculty to effectively adopt these new methods, but also to develop their understanding and their awareness of its value.

In this paper the author will examine strategies to help and support faculty to embrace the new delivery methods and enable them to teach "online".

INTRODUCTION

Many Higher Educational Institutes (HEI's) are now facing increasing pressures, the most obvious of these is funding but they also include competition, technology advances, the balance between teaching and research and student diversity. Increasing diversity in the computing student body brings with it "changing modes of study: more re-education, more mature students, more non-majors and more hybrid degrees and study programs" (Daniels et al, 1998). Changing the way we deliver our courses is one way of meeting these pressures of increasing numbers of students, increasing demand of students while still maintaining a balance of teaching, upskilling, professional development and research.
To enable teaching staff to in some way meet the demands of their institutions and their students by changing the way they deliver their courses, motivation, professional development, training, upskilling and ongoing support are required. "Any significant initiative aimed at changing teaching methods or the introduction of technology into teaching and learning should include effective e-moderator (teacher) support and training" (Salmon, 2000).
Online delivery of courses can enhance student learning and add value to the students learning experience.

WHAT IS E-LEARNING?

Some Definitions

In studying the literature concerned with online delivery of courses there are many and varied definitions of e-learning, e-learning, e-learning and e-Learning. (in this paper I will use the word e-learning to encompass all the different spellings). InternetTime define e-learning as "e-learning is the convergence of learning and the Internet" and they go on to say "e-learning is a vision of what corporate training can become" (www.internettime.com 2001). This clearly defines e-learning in the field of training (as opposed to education) with the emphasis on electronic delivery. Clear (1999) argues that "it is easy to see how the commercial model of standard product delivery largely biased towards information transmission could be misinterpreted as education.".

The University of Technology, Sydney (UTS) however defines e-learning as "e-learning is learning by means of advanced technologies, such as the Internet, intranet, extranet, satellite broadcast, audio/video tape, CDROM and so on. The term e-learning can be used to describe a range of learning situations, including distance learning, web-based learning, virtual classrooms and more. What they all have in common is the use of communication technologies as a medium for learning" (www.education.uts.edu.au/ocourses/elearning/what/index.html, 2001). UTS have broadened the definition to take in many forms of delivery encompassing new and advanced technologies yet clearly the focus is on quality education.

The term "online" encompasses many technologies concentrating today on computer mediated communications. A report commissioned by the Evaluations and Investigations Program, Higher Education Division, Department of Education, Australia uses the term "computer-facilitated learning (CFL)" (McNaught et al, 2000) This term is more in line with UTS's definition and one that is more flexible in an education environment.

ONLINE COURSE DEVELOPMENT

There is a marked difference between the online delivery of a course and having a set of web based resources. In developing an online course, as with the development of any course no matter what the delivery mechanism is, there must always be an educationally sound learning environment.
Online learning is another term that is often quoted and developing a course "online" is a new endeavour for many faculty. We also often hear that XYZ university now has all their courses "online". When investigating this further we often find that the "online course" ranges from a one web page with basic course information to a course that can be studied entirely remotely with sound pedagogy and there is obviously a big continuum in between.

To date, innovation and adoption of online course development has been mainly by enthusiastic and motivated faculty who could foresee the advantages to the students and the advancement of technology that created a more enhanced learning environment for the student.

As a result of the work of these enthusiastic individuals and the strategic direction of the institutions who all seem to want to jump on the band wagon, their colleagues are now being encouraged, if not formally requested to offer their courses online or at least have an online presence. This demand is not only coming from their managers and the universities but also from the students themselves. Students are more demanding and indeed much more discerning about where they choose to spend their education dollar. The student cohort is also changing and becoming increasingly diverse. (McNaught et al, 2000, Daniels et al 1998)). Many students now have access to computer technology in their home (UNITEC Corporate Research report, 2001) and are asking for the ability to access their course materials and resources from off campus locations. It is also more important to them to be able to have access to the lecturer where and when they want.

The staff who have successfully incorporated online components into their courses, cite many advantages to this method of delivery: flexible working conditions, the ability to reach new audiences, it is enjoyable, the opportunity to enhance their technology skills, the opportunity to reach a diverse student population, increased job satisfaction, ease in updating and revising courses and the ability to ensure relevance of course topics. (McKenzie et al, 2001).

Just how much of the course material and teaching resources should a lecturer make available online when the course is taught on-campus? This depends on the technology maturity of the lecturer and where on the online course profile that the lecturer feels comfortable.

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ENABLING STRATEGIES

In order to develop an online component to current traditionally taught courses, adequate support and training for faculty is essential. Strong and focused leadership with adequate support for teaching staff is essential.

Professional Development and Training

Common Mistakes

Too often teaching staff eager to develop their course online fall into common traps, even teaching staff who are well respected in their traditional teaching. Clay (2000) has identified "Five common mistakes of new distance Instructors". These mistakes are equally applicable to teaching staff developing their courses for online delivery. They include:

- putting the textbook online
- Using cutting edge technology when simple measures would suffice
- Failure to develop structure and clear requirements
- Not taking the time to learn the technology
- Failure to interact with the students and follow up regularly.

Early training in the development of online teaching staff can help to highlight these common mistakes and avoid the same pitfalls as the early adopters.

Adequate Training

Many universities have now standardised on one of the many online course development software tools eg Blackboard, WebCT, inhouse developed framework tools, Lotusnotes. Once the decision has been made for the institution then training programs for teaching staff need to be put into place quickly as adequate training before commencement is essential. This training, from the authors own institution's experience, is best done with small groups within schools with early adopters acting as mentors. Once courses are set up, ongoing training and support needs to be available. User groups such as the BUG (Blackboard Users Group) at UNITEC Institute of Technology, provide opportunities for peer support in a non-threatening environment.

Training programs such as that developed by Gilly Salmon of the Open University and described in "E-Moderating: The Key to Teaching and Learning OnLine" (Salmon, 2000) can be adopted as working examples of best practice in the training of staff to participate in online delivery of their courses.

For those teaching staff who do not feel as comfortable with the technology, training sessions on the hardware and telecommunications aspects of their online course delivery are required. This is an often missed area of the training, yet one that would clearly help many non technology literate teachers..

The third area of training that is required is that of the pedagogical requirements of offering courses online. Workshops such as "Preparing your course for online delivery" held as a pre-conference workshop at the NACCQ Conference 2001, New Zealand, is an excellent example of the training required to adjust the teaching to an online environment.

Training Programs for Teaching Staff

Once teaching staff have made the commitment to embrace this new method of delivery, training programs are an essential stage in the professional development of the staff member. Whether using integrated, parallel or distributed approach to staff development typical training programs would consist of workshop and mentoring courses for:

- teaching staff and the "online learning" staff
- new (to online learning) teaching staff and experienced (in online learning) staff
- teaching staff and instructional designers
- introduction to the technology and software

Training Programs for Trainers

The need for high quality staff developers is well recognised (McNaught et al, 2000) Training programs for the trainers are an excellent idea and a good example of these would be the workshops run by the Teaching

Learning and Technology Group held at the University of Notre Dame, Indiana, "A Workshop for Faculty Developers and Technology Consultants on Strategies To Help Faculty Integrate Technology and Pedagogy" (Teaching Learning and Technology Group, 2001).

Adequate Technical Support

The role of the Information Technology Support Centre (ITSC) cannot be under estimated in setting up the infrastructure to enable and support online learning. The expertise and advice of the ITSC staff is required in the design and implementation of the computer networks that will be used for the online courses. Teaching staff computers may also need to be upgraded and telecommunications issues resolved.

The choice of the software tools is also a consideration for the ITSC staff to enable them to provide the hardware to support the software. They will also be involved with the purchasing and the licensing of the software, considerations that are not always forefront when making strategic decisions to be "online".

Once the infrastructure is in place and running, ongoing support is required. The inevitable "crash" of the staff computer requires immediate attention. Students sometimes experience difficulties logging on remotely and then the inability to access the software required as typical problems when accessing their online courses. To overcome the technical difficulties, both hardware and software, 24 hour help desk support is required.

Mentoring Support

One on one assistance is one of the most powerful means of developing staff confidence and expertise, yet it is not always practical as it is perceived as expensive. One example of a mentoring program that has proved successful is RMIT University, Melbourne Australia who have appointed 75 "Learning Technology Mentors" as part of its IT Alignment Program. These faculty have time release to get involved in online course development and work with their colleagues to provide help and support. At UNITEC Institute of Technology, Auckland, several schools have appointed "Online development mentors" (eg School of Information Systems and Computing, School of Accountancy, Law and Finance, School of Applied Management, School of Communication) similar to the RMIT model, where these staff provide training in the use of the online tools and technology and mentoring of staff to develop their own skills and expertise.

Institutional and Administrative Support

To ensure that teaching staff who are contemplating developing their courses for online delivery are fully informed, the institution needs to formu late and articulate the vision of online course development and electronic delivery. Brick, d'Arbon and Robson (1998) report that online delivery can "stimulate more individualised teaching and learning by the staff and students ... and ... spawn new ways of learning previously unobtainable". This must excite innovative teachers who are continuously looking for ways to improve their teaching practice and stimulate their students learning.

Once the decision to embrace and deliver courses online is made, institutions need to build a comprehensive infrastructure to enhance and provide ongoing support for their online teaching staff and students. This needs to include an enhanced network and telecommunications strategy, a software and hardware upgrade policy, and a dedication to the administrative support and the ongoing professional development needs of the teaching staff, articulated in enlightened policies.

Reward Systems

If developing online courses and resources is a strategic priority for an institution then it is essential that teaching staff are adequately compensated for achieving the institution's strategic priorities and objectives. Rewards can come in different ways, they can be individual rewards or team rewards and also vary from individual to individual. Some institutions have a bonus system for teaching staff and one way of compensation is to set objectives with the staff member and pay a bonus when the objectives are met.

Another option to reward staff is to offer international conference attendance. This method of reward is twofold as the staff member is able to meet and hear international experts and also make personal contacts that are beneficial to themselves personally and also to the institution.

Another successful strategy is to offer time release to staff who are keen and ready to develop their teaching online. This can be an initiative that is funded within schools, maybe paid for from entrepreneurial funds or research grants.

Other reward systems that have worked successfully are the offer of special or "cutting edge" computers and other technology to those staff who are developing courses.

Each reward is really individual and what is an incentive to one staff member may not be to another. Determining in advance what incentives are being offered is the best way to encourage, support and recognise the superior performance of teaching staff.

CONCLUSION

Teaching is still teaching whether it is done online or at the front of a classroom. In this age of rapidly developing technology, students are demanding faster better access to the material that will help them learn. "Students are able to manage their learning more effectively with resources and systematic information at their fingertips." (McNaught et al, 2000). HEI's that are cognisant of this requirement need to offer this service to their students. The students of the future will be the "play station generation" they will want learning that is "Just in time, just for me, just a keystroke, just for now" (Spender, 1999, as quoted in Salmon, 2000).

"Higher education has begun an irreversible transformation - with information technology as the catalyst. New technology options arrive at an accelerating and confusing pace. The flood of information that confronts us daily hinders our best efforts to keep up with it." (Teaching Learning and Technology Group, 2001) Adequate training programs for faculty and adequate support for the technology are the keys to success in this new and constantly developing environment.

Some higher education institutions may choose not to offer any courses online, these will be the few elite that can stand by with other major unique selling points. However to continue to provide high quality education to an increasingly demanding and technologically literate society, higher education institutions that wish to maintain a place in the education of our future generations must embrace online delivery of their courses now. Wherever, whenever and however a course is delivered a teacher will always need to be there. Recognition, training and support of the teacher is therefore of paramount importance.

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Multimedia Retrieval Service In Hanmir

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Abstract: There are many retrieval systems on the Internet, which are aimed at finding exact data that users want. Since Internet today is a pool of multimedia contents such as image, audio, and video, retrieval services should be able to search and browse multimedia content efficiently.

In this paper we describe the organization and functionalities of multimedia retrieval service of Hanmir, which is based on MediaWarez[4], a multimedia retrieval system developed by Korea Telecom Multimedia Laboratory. These things are mentioned module by module especially at the point of data operating.

1. Introduction

It is difficult to find any exact multimedia data that users want out of a lot of one on the Internet. In the near future various multimedia contents will be circulated in the network. Users will be able to access these multimedia contents by using their own computers or multimedia monitors. Today lots of multimedia retrieval services exist but most of them offer very limited contents or text-based one [5]. The text-based search engines are not so efficient to retrieval multimedia contents because text has very limited capability to present the complex multimedia contents. For example, it is difficult to find a car with a specific color and design by using a text-based search engine. Text-based search engine cannot also offer pictures which has similar image with one picture, abstract paintings or pictures, and symbols. Search engines that can find these multimedia contents are organized by several technologies; collecting multimedia data, indexing data, and querying them on the real server[2].

In this paper, we propose a new image content search and retrieval system using text and image features. In the chapter 2, we describe all system components generally and explain them at the point of data operation. Implementation Environment is mentioned in the chapter 3. In the chapter 4, we conclude this paper and describe the further study.

2. System components

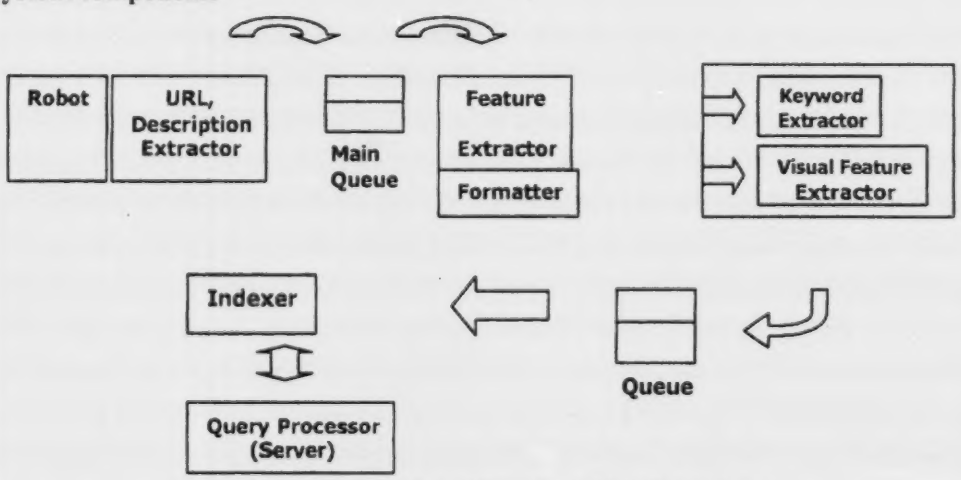

Fig. 1. Organization of Hanmir multimedia service

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This picture is the organization of MediaWarez.
Mediawarez consists of document collector, feature extractor, index server, and service server.

2.1 Document collector

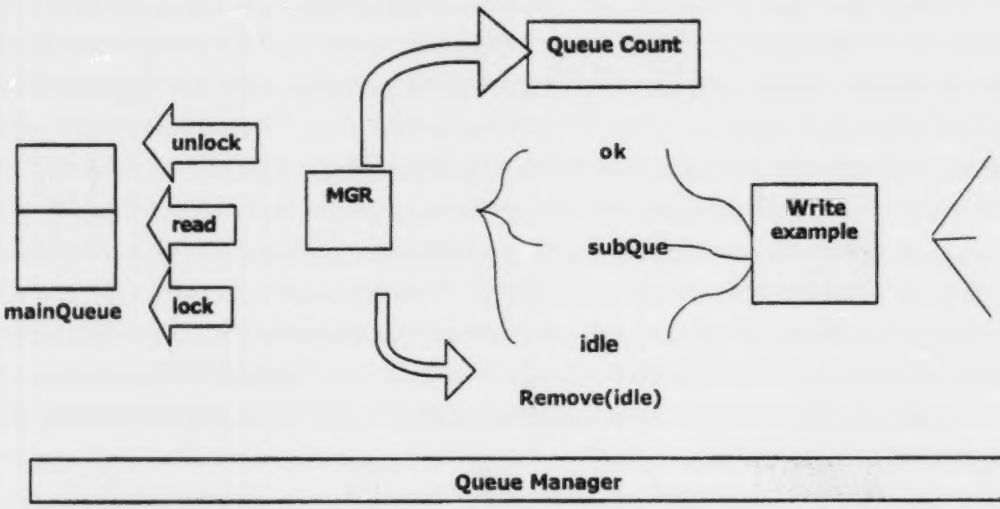

Fig. 2. Module of document collector

A document collector is a robot traveling Internet and gathering HTML documents. The robot extracts URL, invalid dictionary, proper noun dictionary, and Invalid URL list files.

The document collector carries out appointed processes, Getsite.exe, and each process starts traveling URL and brings data.

2.2 Feature Extractor

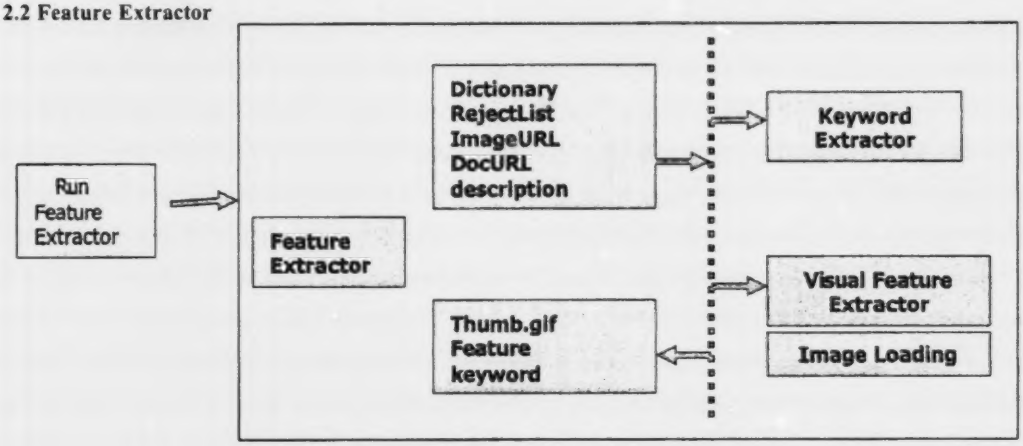

Fig. 3. Module of feature extractor

Feature extractor is devided into two parts; descript extractor and vis ual feature extractor.

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Descript extractor extracts keywords, document URL, media URL, and size out of the data passed by the document collector. Visual feature extractor makes Thumbile sketches of images and stores the extracted visual features of images into a file.

The system of feature extractor consists of many processes and much amount of data can be processed simultaneously. A main-cue and a sub-cue motivate the feature extractor.

Each process work on the sub-cue and writes the result on the main cue. This feature extractor works not only in one system but can be accessed by other systems

2.2.1 Keyword extractior

Keywords for an image are extracted from the alt tag, the document title, headline, URL, or text around the image. In this case, the extracted keywords does not always represent the exact images, but in many cases the keywords are valuable.

After this process, unnecessary keywords such as particles or nouns in invalid dictionary are deleted. Proper nouns are very important in keyword extraction because they can become the main keywords that used frequently. MediaWarez have made a special proper noun dictionary.

2.2.2 Visual feature extractior

MediaWarez can retrieval image, video, and audio but content-based search can be applied only to image at present. For this reason, the visual extracting module processes image only.

An image can be represented by its features such as color histogram, color layout, texture etc[6,7]. Each feature can be obtained by time or frequency domain signal processing techniques. We select three image features. Color histogram[2] is obtained using traditional method [2], and color layout and texture[3,4] are obtained using wavelet transform [3,4]. Since the methods do not require large computation power, we can easily handle a large number of images. The obtained features are saved as a vector form and used for indexing and search procedures.

In searching similar images, several visual features can help to retrieval more accurate image. Searching similar images compares many features of one image with those of other images. If the size of the feature is big it takes more time to compare.

MediaWarex focuses on fast searching on much of multimedia data and sacrifices the accuracy.

2.3 Inde xing scheme

It is important to search efficiently a large amount of data on the Internet. To be a useful retrieval engine, similar images search is included in keyword-based search.

As the system is not for a simple keyword-based search, we do not use a data- base but construct a unique indexing scheme. This indexing technique is off-line processing and has a tree structure in which operates on indexing procedure in memory. When the tree structure finishes the processing, the indexing structure is constructed in files that can help to find quickly any group or media Ids wanted. Cues which is made in the extractor contains a series of lists. For example, image URL, text URL, visual feature file location, keyword file location, information file location are in the list of images.

The indexing of this system is managed into Id. Each image is given its own Id. Visual features on a cue are stored in visual feature table and other data is stored in data table. Finally, a keyword related to an image become its Id and the image is put into an indexing file which is equivalent to the keyword. Similarly, every image file is put into ImageIndexFile to search images as a whole.

MediaWarez uses a noble indexing scheme based on birch algorithm[6]. The indexing scheme is implemented with two steps. First, a tree is constructed, which includes whole images. This tree is used when the query is only visual features. The next step is to construct a tree for each keyword. The number of keywords used frequently is not so many, and each tree is very small. So making trees is an easy work. These trees are used for the query that combines keywords and visual features.

Fig. 4. Result of content based image retrieval in Hanmir Multimedia service.

2. 4 Search methods

When the indexing is finished, data is passed to queries. These data are needed for query; indexing tree, Information table, feature table, keyword tree, and Index Flie which is a single indexing tree.

Three types of queries are possible, which are keywords, visual feature, and the combining of both. The keywords query accesses the center of the first cluster in the related trees. This can show a set of images that are visually not similar. The visual feature query, at the first time, compares the query features and the saved features in the main tree, and shows a set of images that have similar visual features to the query. The combined query is implemented as visual feature query except using the trees that are obtained by the keyword access.

2.5 Video and audio retrieving

In cases of video and audio retrieving, Hanmir Mutimedia service system does not adopt content-based retrieval method yet but keyword search only. it decorates the result with the brief video searching and makes brief information. In case of audio, Hanmir Mutimedia service system does not offer any contents information of audio except for keywords as most of all searching services. itgives the two URLs for audio itself and document holding the audio, the type of audio, and some keywords extracted from title and context of document.

3. Implementation environment

Document collector, feature extractor, indexing scheme are implemented by C or C++, based on Unix.
Search module is implemented by cgi, or NT IIS.
Hanmir multimedia service is internet address is msearch.hanmir.com.

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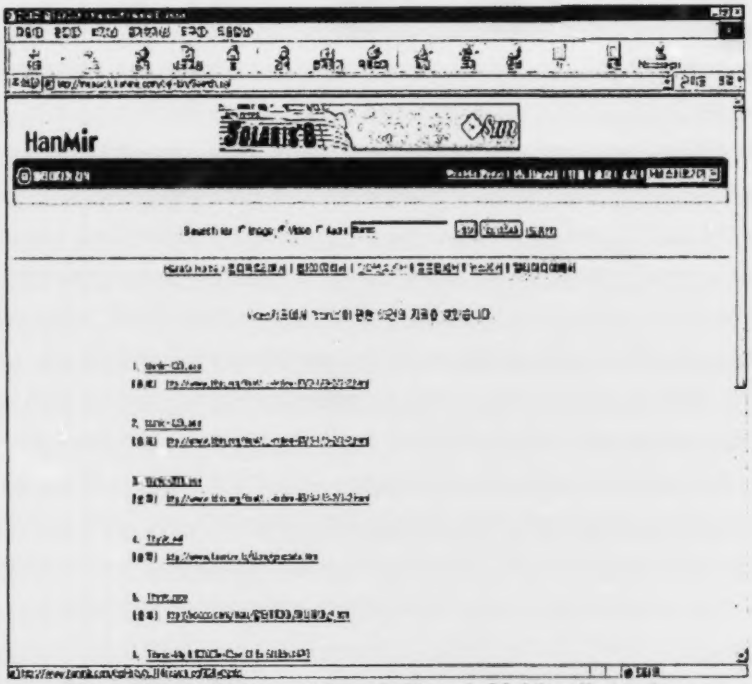

Fig. 5. Result of Video retrieval in Hanmir Multimedia service .

4. Conclusion

In this paper we described the general organization and functionalities of MediaWarez, the multimedia retrieval system, at the point of data processing. This system is a part of Hanmir (msearch.hanmir.com) [1] . Its search method and speed are better than other existing systems. This system is not a prototype but a real-serving one. It provides a fast and accurate service for a large quantity of data. This system uses a query combined with keywords query and content-based query.

For the further study, exchange to XML-based one will be need for compressing the size of features, developing search efficiency, and transmitting or converting data. Now we study a multimedia retrieval system which combines a mass multi-modal retrieval system and the Relevance Feedback system.

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Design and Early Implementation of an Extensible XML Repository

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Abstract: Our work introduces an open architecture for an extensible XML Repository, supporting document-centric content management. We analyze our research-oriented implementation, which maintains all the repository's data and metadata in XML format, leverages proven concepts from DBMSs, features design and runtime phases and combines best-of-breed tools to provide rich functionality, including relationships and online authoring.

1. Introduction

XML Repositories are a most characteristic example of emerging complex environments for handling XML Data and supporting XML applications. An XML Repository can be loosely defined as *an integrated environment, usually database-driven, for storing, retrieving and manipulating XML content (files)*. This can be done either in the form of native XML documents (including document classes, their collections, parts and relationships), in which case we are referring to *document-centric* applications (Bourret, 2000), or as more fine-grained XML data, mapped into and built from existing information stores, in *data-centric* solutions.

The term "XML Repository" encompasses a range of technologies and products, from XML-Enabled Content Management Systems to XML-Enabled Databases. It reflects the document- and data-centric potential of XML and the evolution of XML, from a pure document markup language into an extremely powerful data interchange format. XML Repositories are attempting to leverage XML's benefits in a more consistent, robust and high-performance manner. In other words, they strive to achieve the same level of functionality and robustness offered by DBMSs.

Our work addresses the open issues of extensibility and maturity of XML Repositories primarily from an R&D perspective, following up on our theoretical research on more systematic approaches to managing hypermedia content and applications (Christodoulou, 2000), (Zafiris, 2000), and leveraging our extended practical experience in the continuous operation and evolution of large-scale Web sites of Greek Governmental organizations. More specifically, we shall focus on the use of XML Repositories *for document-centric content management*, a solution applicable to a significant number of Web sites, especially those with large-scale content and diverse information categories.

In Section 2 we summarize a taxonomy of XML Repositories. Our proposed architecture for an extensible XML Repository is presented in Section 3. Section 4 discusses the organization of XML content and auxiliary structures. Section 5 further explains the design and runtime phases of content management. Other services are examined in Section 6 and conclusion statements are provided in Section 7.

2. A Taxonomy of XML Repository Technologies

Following up on the introductory definitions, *data-centric* XML files are those files where XML is used as data transport and whose physical structure is often unimportant, such as sales orders, scientific data, flight schedules. They are meant primarily for machine consumption (i.e. automated processing by computer software). *Document-centric* XML files are those where XML is used for its SGML-like capabilities. These documents are characterized by irregular structure and mixed content and their physical structure is important. Document-centric files are mostly for human consumption. Examples of document-centric applications are document/content management solutions, Web, Intranet and Extranet sites management, enterprise workflow applications, corporate information portals.

Building upon the classification of XML Repositories/Databases by the XML:DB group (XML:DB, 2000) and R. Bourret's categorization of XML Database products (Bourret, 2001), we have introduced (Zafiris, 2001) a more generic taxonomy of XML Repository technologies, which is summarized in (Tab. 1):

	Document-centric use (as XML docs)	Data-centric use (as data)
Content Management Systems	x	
Native XML Databases	x	x
XML-Enabled Databases		x
XML-DB Middleware & DBMSs		x
XML Servers		x
XML Application Servers	x	x

Table 1: XML Repository Technologies for Document- and Data-Centric Uses

By analyzing and evaluating the various solutions for XML Repositories and the advanced features of leading products in each category, we conclude (Zafiris, 2001) that the current phase can be considered as the first or second generation for most tools and products, with the overall taxonomy gradually getting more clear. Especially when it comes to Native XML Databases, this is their beginning stage, and a very promising one. Unfortunately, very few products and solutions can claim a relative maturity or relative breadth of services. In most cases, emphasis is placed on certain features and there's a lot left to be desired overall. Most of the products remain too proprietary or monolithic in nature, making it very difficult to keep up with the constant introduction of new XML standards. The fact that companies rush to support emerging XML-related standards, which by themselves are unproven in solving certain puzzles of XML Repositories (e.g. effective querying), makes for poor implementations and introduces an additional risk factor.

Our recommended approach is to strive for practical applicability and maturity of basic services of XML Repositories. In parallel, it is important to evolve to open, modular and extensible product architectures, in order to enable faster support of revised and emerging standards and to enable easier development of applications, which will put XML documents and data to actual use. Furthermore, a lot of help, both for the research and the improvisation of actual products, can be derived from existing knowledge gained through decades of research into fields such as Databases and Knowledge management (Ceri, 2000).

3. Repository Architecture

Following up on our observations of the previous Section, we introduce a document-centric content management environment, with XML as the cornerstone technology, built around an open architecture for easy extensibility. This objective serves not only research-oriented purposes, but more importantly provides an answer to the need for structured content management in current and next-generation Web Sites with extended amounts of diversified information. Such installations include large-scale Web Sites of corporations and governmental agencies, such as of the Greek Ministry of Culture (Ulysses, 2001), which are maintained and constantly evolved by our research laboratory. Our repository Architecture comprises three major, discrete layers, as depicted in (Tab. 2).

Content designers and authors accessing the Repository with Web browser	
Web Application Server	
Content management/authoring (via server-side Web applications implementing specific *services* and *workflows*)	Content modeling /conceptual design (using DTDs/XML Schemata, to define Document Classes, collections, relationships)
Physical Storage & Content organization (using existing hierarchical file systems)	

Table 2: Discrete Architecture Layers

All repository functionality is available through online Web interfaces, and implemented via server-side Web applications, which interconnect best-of-breed or open-source tools and custom, "glue" code, to implement desired services and workflow. In our prototype implementation, we are using the Apache server over Windows 2000 and Solaris platforms, with our server-side "glue" and processing code primarily written in Perl and Java, over Microsoft's XML parser.

Content, as well as all the auxiliary (meta)data structures required for implementing core repository functionality (unique naming of resources, modeling 1-1, 1-n, n-n relationships between XML files and/or their elements, implementing such relationships at authoring time), is stored natively as XML documents. Thus, the innovation of our approach lies (i) in maintaining not only all documents, but also all related / auxiliary structures, in XML form and (ii) allowing the use of XML standards and APIs for manipulating the data. In the same time, we try to leverage best-of-breed solutions and features found in Database systems, traditional Content Management Systems, Native XML Databases, towards an open and extensible platform for XML Documents/Content Management.

Of course, it is not possible to support a full range of services (discussed in Salminen, 2001 and Ceri, 2000) right from the early versions of our Repository. However, our overall design allows for adding new features and functionality, without sacrificing existing work and content, thus increasing robustness and maturity.

4. Content and Auxiliary (Meta)Data Organization

Leveraging Concepts from the Databases Domain

A key starting point in our Repository is that all XML content should be not only well-formed, but also valid, following syntax specified by DTDs or XML Schemata. A DTD thus defines a *DTD Class*, similar to a documents collection which contains all XMLs based on this specific DTD.

Equally important is the "mapping" of XML Repository concepts to Entity-Relationship Database concepts. Mapping is not a physical or programming procedure. It is, rather, an attempt to establish analogies between the two domains, so that we can take proven ideas from one domain (DBs) and apply them to the other (XML Repositories).

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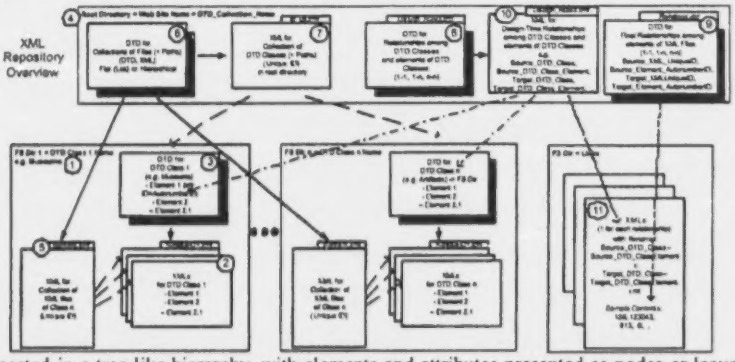
Initially, we consider a DTD Class (a basic content category), to be similar to a DB table. It is typical for content designers and authors to organize their material in autonomous categories (which of course may be interlinked), such as products, marketing, support, projects, etc, and create content (documents/files) in each category. For our purposes, we assume that all content is in XML documents format already, or can easily be converted from other existing data sources. Thus, a Collection of DTD Classes, which effectively corresponds to a whole Web Site (collection of content categories), can be mapped to an entire *Database*. Each DTD Class has its own elements, which



are arranged and interconnected in a tree-like hierarchy, with elements and attributes presented as nodes or leaves in it. These elements can be "mapped" to fields of a *DB Table*. Finally, an XML file itself can be "mapped" into a DB Table *record*. Both represent a specific *instance* of content, following the specifications of the DTD Class or the Table, respectively. Overall, these assumptions allow us to specify any DTD Element in a hierarchical manner, similar to identifying a DB Table field: *DTD_Collection.DTD_Class.DTD_Element ~ DB.Table.Fields*

(Tab. 3) summarizes the aforementioned mappings.

Collection of DTD Classes (Web site) ~ DB
DTD Class ~Table
DTD elements (tree) ~ Fields (Flat)
XML file ~ Table Record
XML file: instance of a DTD Class ~ Table Record: instance of a Table

Table 3: Mapping of XML Repository Entities to DBMS Concepts

It is obvious that, based on this mapping, we can easily author code which automatically *exports/translates/converts* content from existing hierarchical DBMSs into collections of DTD Classes. The DTD files themselves can automatically be *inferred* and created, by closely following the DB schema.

Physical Storage and Content Organization

For physical storage of our content, namely our DTD and XML files, we can use any modern, high performance file system, with builtin support and API for advanced security rights managements, built around users, groups, access control lists. Our current implementation has been tested with NTFS 4.0, NTFS 5.0, and UFS. Optional, but welcome features of the filesystem, include indexing facilities in coordination with the O/S and custom medatada fields fine-tuned to our requirements for storing XML classes and files.

Further on, (Fig. 1) presents a very clear solution to how we can organize our content and demonstrates the grouping and hierarchies of DTD files and XML files, which can be part of a Web Site or of any collection of content categories in general.

Figure 1: Content and Resources Organization within our XML Repository. Shadowed boxes are used to represent DTD files. Straight continuous lines point to XML files using syntax from the "origin" DTD. Dashed lines indicate links/pointers to elements (information) within the target files.

More specifically, for each DTD Class we create a directory with the same name (a unique string, such as "museums"), as seen in (1). Thus, XML files (2) of the same DTD Class are placed within this directory, along with the DTD file (3) which defines their syntax. Each XML file is identified by a unique ID instead of a string (e.g. 101.xml). In this manner, we can uniquely reference our resources within our Repository (a resource may be a DTD or XML file or even an element of such a file). On the top-level of the hierarchy, the root directory (4) has the name of the content categories *collection* or Web Site, *DTD_Collection_Name*. The similarity with E-R DBMSs in resource identification is profound:

[DTD_Collection_Name].DTD_Class_Name.XML_Unique_ID ~ [DB_Name].Table_Name.Record_Unique_ID

Additionally, in all directories, an XML file (5) (with its syntax defined by a DTD (6) at the root directory) maintains a list of the other XML files contained within the same directory. A similar XML file (7) a the root directory maintains a list of the content categories (DTD Classes) underneath.

The above storage solution scales very well, and is in deployment at Governmental Web Sites and Intranets, with more than 30 DTD Classes and 15,000 discrete XML documents within. To overcome the problems of conflicts that may arise when accessing and using resources from different XML Repositories, we use XML Namespaces.

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Unique Referencing of Resources

In the previous paragraphs we saw how we establish a unique name for each DTD and XML file in our Repository. Furthermore, it is absolutely critical that elements within these files can be also referenced/ identified in a unique, efficient and uniform way. Unique identification is necessary for all services within the repository, such as the creation of relationships among classes and/or class elements and the queries on content. We opted to use the XPath standard for uniquely referencing elements within *DTD files*, as it supports referencing among data sources with notations of the form /root/child/child/….

The careful observer will notice that XPath cannot be *easily* used to reference uniquely elements within an XML file, since an element might be appearing more than one times at the same branch of the DTD (ELEMENT_NAM E+). For that reason, we introduce a simpler solution by assigning *unique IDs* to elements within *XML files* (e.g. 43245435). Each XML element has therefore an ID attribute offering "Autonumber" functionality.

This is the first example of differentiating between the mechanisms used in the *content modeling phase* (when the content designer organizes the content categories and their elements) and the *data authoring phase* (when the content author uses the available designs to author and modify content). DTD (or XML Schema) creation obviously belongs to the first phase, whereas XML authoring belongs to the second phase. This approach, also widely used in many DBMSs, is especially important for the internals of our XML Repository. The database architect sets up tables, fields, relationships, and creates data-entry forms, before the users are able to insert and manage information.

5. Design & Runtime Phases

Design is our content-modeling phase and is used to define the various content schemas which our Repository will support. *Runtime* is the term for our data-authoring phase. These two phases correspond to the *Content modeling/ conceptual design* and *Content management/ authoring* layers of our architecture, respectively. Thus, splitting of operations within the Repository into two phases, Design and Runtime, provides improved flexibility, and is a core concept of our approach. Based on this two-pronged solution, we can treat the work of any service in two different phases, code separate routines, and create independent workflows for the content designers and the content authors. We shall examine the core service of establishing relations (links, relationships) among resources (files, elements) within our repository, in a manner that overcomes current limitations, since most tools are unable to support the existing standards for linking XML resources.

Establishing Relations(hips) Among Resources

Our intention is to be able to establish links not only among XML files, but also from elements to XML files (and vice versa), as well as between elements. An example is the linking from $element_1$, identified as the */root/childAtLevel1/leaf_name* of DTD1, to $element_2$, identified as */root/childAtLevel1/ childAtLevel2/leaf_name* of DTD2. Furthermore, we should be able to set attributes upon the links, specifying additional properties that the link should have (e.g. direction, language, topic, ….). These objectives are fully in line with the capabilities for relationships provided by ER DBMSs. In the next paragraphs, we analyze our approach for establishing the links/relationship *rules* at the design phase, and then proceeding with actually *linking* specific XML files and/or elements at the runtime phase.

Representing Relationships in the Design Phase

In the Design phase we use two additional DTDs in order (a) to describe the schema of all possible relationships among different data elements (no matter of which class), and (b) to specify the syntax, based on which these relationships will be maintained in XML files. Relationships may be established (i) among DTDs in general (similar to 1-1 relationships in DBs), (ii) between elements and DTDs (similar to 1-n relationships), (iii) among elements of different DTDs (similar to n-n relationships).

The first DTD (*Design_Rules.dtd*, (8) in (Fig. 1)) lays in the root directory of the site and supports the design of Relationship Rules, which must implement all kinds of relations (1-1, 1-n, n-n) between 2 DTD Classes and/or elements of DTD Classes. We are capable of extending this DTD at any time by introducing new elements that characterize the Relationship in a more sophisticated way. Each Relationship Rule, according to this DTD, has the following basic elements:

- *Source_DTD_Class*: name of the source DTD Class
- *Source_DTD_Class_Element* : an XPath expression uniquely referencing the element within the specific DTD. If it has the value "Name" (top-level title), this denotes that the Source is the DTD Class itself (1-n).
- *Target_DTD_Class*: name of the target DTD Class
- *Target_DTD_Class_Element* : an XPath expression uniquely referencing the element within the specific DTD. If it has the value "Name" (top-level title), this denotes that the Source is the DTD Class itself (n-1).
- *Link_Description**: a string, with one instance for each supported language (which is an attribute to this element)
- *Link_Type*: a fixed string, selected from an enumerated list (e.g. "hyperlink")
- *Direction*: a fixed string, selected from an enumerated list (e.g. "left")

The second DTD (*Relations.dtd*, (9) in (Fig. 1)) also resides in the root directory of the site and describes the syntax by which final, "instantiated" Relationships among 2 DTD Classes and/or elements of DTD Classes will be kept in XML files under the directory

"Links" (below the root directory). Basic elements specified in this DTD are:

- *Source_XML_UniqueID*: name of the source XML file
- *Source_ Element_AutonumberID* : a unique number within this XML file – basically the ID value of the element within the source XML file. If 0, it indicates that the relationship is with the XML file itself and not with a specific element.
- *Target_XML_UniqueID*: name of the target XML file
- *Target_ Element_AutonumberID* : a unique number within this XML file – basically the ID value of the element within the target XML file. If 0, it indicates that the relationship is with the XML file itself and not with a specific element.
- *Attribute_Name**: name (string) of an arbitrary property.
- *Attribute_Value**: the value (string) of the aforementioned property

We support multiple custom properties with their respective values.

Representing Relationships in the Runtime Phase

Deriving from the DTDs of the previous subsection, the instantiated relation(ships) among specific XML files and/or elements of XML files are stored in the following manner:

1. We use one XML file (based on *Design_Rules.dtd*) named *"Design_Rules.xml"* (see (10) in (Fig. 1)), located in the root directory to maintain all "tuples" of Relationships among XML files and/or elements of XML files. A simple example of this file is presented in (Tab. 4).

```
<Design_Rules>
 <rule id="1">        1-n
        <Source_DTD_Class>Museums</Source_DTD_class>
        <Source_DTD_Class_Element>Museum/Contains</Source_DTD_Class_Elemen
t>
        <Target_DTD_Class>ArtCollection</Target_DTD_Class>
        <Target_DTD_Class_Element>Name</Target_DTD_Class_Element>
        <Directio  1-1  </Direction>
        ...
 </rule>
 <rule id="5">
        <Source_DTD_Class>Museums</Source_DTD_class>
        <Source_DTD_Class_Element>Name</Source_DTD_Class_Element >
        <Target_DTD_Class>PostalCodes</Target_DTD_Class>
        <Target_DTD_Class_Element>Name</Target_DTD_Class_Element>
        <Direction>Left</Direction>
        ...
 </rule>
.....
</ Design_Rules>
```

Table 4: Sample of "Design_Rules.xml"

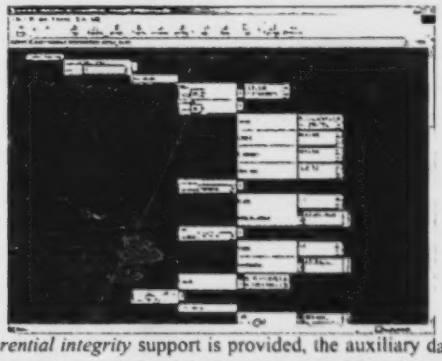
2. In the directory "Links", one XML file (according to *Relations.dtd*, see (11) in (Fig. 1)) *for each* relationship among 2 DTD Classes and/or elements of DTD Classes. which maintains all relations (instances) based on a certain Relationship Rule. The names of these XML files are unique and correspond to the respective Relationship Rule described in *Design_Rules.xml*. Thus, the name of each XML has the following syntax:
   Source_DTD_Class--Source_DTD_ClassElement x Target_DTD_Class--Target_DTD_ClassElement.xml
   where Source_DTD_Class_Element and Target_DTD_Class_Element are the XPath notations for the specified elements, with the / delimiter converted into -. For example, a name of the XML corresponding to rule 1 of (Tab. 4) would be *Museums--Museum-ContainsxArtCollection--Name.xml* and its contents may look like:
   150, 123342, 613,0,, ,,
   152, 32847, 234,0,, ,,

indicating that specifically two *Museums*, with XML IDs 150 and 152, have their elements "Museum/Contains" with Autonumber IDs 123342 and 32847 linked to *ArtCollections* with XML IDs 613 and 234, respectively.

6. Other Services

In our *authoring* environment, all server-side processing code is written in Perl and/or Java, which renders data-entry forms in typical HTML/Javascript code, for the content authors, as depicted in (Fig. 2). We are able to open, import, process and save/export any XML file, given an appropriate DTD or not, in any operating system.

Figure 2: Snapshot of the content authoring phase, working on an existing XML file. Notice that the author can insert data in any language, add or remove instances of elements, and do everything remotely from the content server, using his/her browser.



It is obvious that, unless *referential integrity* support is provided, the auxiliary data specifying the design-time relationships and the actual links themselves would be easily corrupted and the Repository would not be reliable. Since all authoring and linking operations are performed via online interfaces, the underlying server-side code checks and maintains referential integrity at each step. Specifically, all operations involving resource modification (e.g. deletion of an entire DTD Class, deletion of an XML, addition of another XML element or instance of an XML element within a file) trigger within our server-side code routines that enforce referential integrity rules, including cascaded update & delete. We should highlight that most server-side code is written in Perl, which integrates Microsoft's XML parser for all XML-related operations (traversal, element search, etc.) for supporting Greek (and other languages) encoding.

For *versioning control* purposes, we are using the mod_dav module of the Apache server, in order to leverage WebDAV's (Network Working Group, 1999) facilities. In Solaris platforms, we are alternately using RCS, which also provides check-out/check-in functionality, incremental maintenance of file differences, rollback to previous versions. Our online interface provides a visual "wrapper" interface for these operations and fully integrates them into the authoring process described in the previous subsections.

For *metadata authoring and extraction*, we define target metadata sets in RDF (using XML Schema) and for each content category (DTD Class) maintain mapping tables from its elements into target metadata fields, e.g. Museums/Museum/Description => DublinCore/Description (DCMI, 1999). In this manner, we are able to automatically export our metadata fields via Perl and XPath processing. The author is prompted to validate the results of the automated process, and is able to correct any output fields. We are able to freely add metadata sets, beyong Dublin Core, as befits our needs for "tagging" our content and providing RDF records to other applications and services, which are using our repository (e.g. thesauri of Cultural terms).

Different views into the content are automatically built when the user logs into the system. Depending on the content author's privileges, the proper content categories, XML files and even specific elements are presented to him/her for viewing and editing, after filtering and transformations performed using XSL and XPath. Elements which are not editable are presented optionally as read-only, for cross-referencing purposes. End-users without any authoring rights are similarly presented with the content for which they have open/view access control. Data regarding access rights is maintained also in external XML files, but our next step is to integrate LDAPv3-compliant queries (dynamic access control lists – ACLs) as attributes of each DTD/XML element, in order to specify in a dynamic manner the users and groups (e.g. derived from the organization's LDAP server) who have the proper modification rights for that element.

For *joins*, we are working on utilizing XQuery. The XML Community should and will give great importance to the above work, since queries (although being one of the most complicated implementations) are of vital importance for extending web services. We are in the process of designing our own tools to support the above Working Draft.

7. Conclusions

In this work, we have examined the design and undergoing implemention of an extensible XML Repository focusing on document-centric services, which (i) uses XML to represent not only the content, but all auxiliary Repository structures, (ii) leverages best-of-breed or proven open-source tools and (iii) integrates them through "glue logic" in Perl and Java, thus providing easy extensibility and rapid support of emerging XML standards. The adoption of established concepts from E-R DBMSs, for modeling content classes and content relationships, is fully combined with our layered architecture, thus offering discrete Content modeling (conceptual design) and Content management/authoring phases and workflows.

Our ongoing implementation provides a live platform for constant evaluation and experimentation with existing and emerging XML standards, while in the same time providing support for large-scale content management in live Web Sites. We plan to gradually release this platform to other researchers and third-parties, for research and addition of new features and functionality. In conclusion, when compared with professional products such as the native XML databases or Content Management Systems, our platform cannot of course compete in performance, yet is ahead in ease of use, extensibility, programmability and open features.

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Website Usability and Content Accessibility of the top USA Universities

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Abstract: This study investigates whether the websites of the top USA universities are ranked high in terms of accessibility and usability and if these two measures are correlated. The usability and accessibility of the top fifty USA universities (USNews, 2001) were measured using two automatic evaluation tools: Bobby and LIFT. The results show a low compliance (30%) with Web site Content Accessibility Guide and a low usability rating for most of the university websites. The accessibility approval was found to correlate significantly with overall usability ratings of the websites. The size (in Kb) of the website was found to be a driving variable both for usability and accessibility.

Introduction

Currently over 30 million people in the United States and many more millions worldwide have physical, sensory or cognitive limitations that make interacting with traditional monitor, keyboard and mouse configurations difficult (Laux, 1988). The number of people with disabilities is expected to increase significantly in the next decade as the United States' and world's population is rapidly growing older, and the number of World Wide Web (WWW) users of old age also increases exponentially (U.S. Census Bureau, 1999, Curry, 1999).

To make computer technology accessible to people with disabilities, companies provide specialized human computer interface devices (e.g. special mouse for people of age that have difficulty in motor movements, special magnification for monitors, special keyboards). However, although being able to interact with a computer is a necessary prerequisite to using the WWW, the web provides unique features (dynamic content, heavily graphical user interfaces, complicated navigation structures) that often make accessibility a more complicated challenge.

Definition of Web accessibility and Universal Design

Many people have been advocating a universal design strategy when designing web interfaces. Universal design refers to the design of products and environments that are usable by all people, to the greatest extent possible, without the need for case-by-case accommodation. If you adopt universal design when developing WWW pages, your pages will be more readily accessible to most people with disabilities who are already using computers (Laux, 1988).

Chuck Letoumeau (2001) defines web accessibility to mean that "anyone using any kind of web browsing technology must be able to visit any site and get a full and complete understanding of the information as well as have the full and complete ability to interact with the site if that is necessary".

Universities and Web accessibility

Apart from the many social and economic motivations for addressing Web accessibility, regulatory compliance is becoming an important factor.

More specifically (Laux, 1988):

1. When a web site is used in a job or in schools or universities, accessibility becomes an issue that may be addressed by the Americans with Disabilities Act of 1990 (ADA).
2. If employees need to use an outside Web site for a critical job function, the employer or institution may be responsible for providing adequate access.
3. If web sites are designed so that current adaptive equipment cannot make the pages accessible, employers and educational institutions may have difficulty providing acceptable accommodation (e.g. heavily graphic oriented web pages).
4. A service provided to the public via a web site or page that is not accessible to users with disabilities may be subject to an ADA claim; and more important, the service provider may loose market share because many potential customers are unable to access the service.

Also there are significant legal reasons for making sure that the university campus web pages are accessible. By failing to provide access to the internet, universities have been found in violation of Section 504 of the Rehabilitation Act of 1973 and Title II of the Americans with Disabilities Act of 1990 (Campbell & Waddell, 1997). Others (Margolin, 1998) advocate that inaccessible web pages are also in violation of Title III of ADA since the internet is a public space.

Usability and Accessibility Mandates, Guidelines and Tools

There are some encouraging signs that the accessibility of the Internet is taken into account by mainstream society (Newell & Gregor, 1997). Accessibility for information on the Web has been well regulated in the U.S. Some legal mandates regarding accessibility are Section 255 of the Telecommunications Act 1996 (http://www.fcc.gov/cib/dro/ section255.html), which regulates the accessibility of Internet Telephony, and Section 508 of the Rehabilitation Act Amendments of 1998 (http://www.ed.gov/offices/OSERS/ RSA/RehabAct.html), which requires that when Federal departments or agencies develop, procure, maintain, or use electronic and information technology, they shall ensure that the technology is accessible to people with disabilities, unless an undue burden would be imposed on the department or agency.

Sullivan and Matson (2000) compared 50 most popular web sites in terms of their usability and content accessibility and found a marginal correlation (ρ=0.23) between manually analyzed content accessibility in conformance to the Priority 1 of the WCAG and overall automated usability testing result provided by LIFT (http://www.usablenet.com/index.htm). The present study extends Sullivan and Mason's study in two ways: by automating the content accessibility testing using Bobby (http://www.cast.org/bobby), which performs the test based on all Priorities, and by performing group comparisons of university web sites in terms of their usability and content accessibility.

This study aims to answer two research questions:

1. Are top university web sites rated highly in terms of accessibility and usability?
2. Is the result of accessibility evaluation of university web sites related to the result of their usability evaluation?

The two automatic evaluation tools used in this study are LIFT and Bobby. LIFT was chosen because it is the only automatic tool that performs usability evaluation. Bobby was one of the most widely used automatic accessibility evaluation tool.

LIFT provides a report of the number of catastrophic errors (errors that disable users to complete tasks), major errors (errors that cause users to face major impediments), minor errors (errors that are really a nuisance for users) and cosmetic errors (low priority materials). In addition, as a general rating, LIFT assigns a rating of excellent, good, fair or poor.

Bobby recommends effective Web page authoring for special Web browsers (e.g. the one which reads text out loud using a speech synthesizer for blind users). Bobby divides the accessibility errors into 4 sections to be tested:

1. *Priority 1 Errors* are problems that seriously affect the page's usability by people with disabilities, in accordance with Priority 1 of WCAG. A Bobby Approved rating can only be granted to a site with no Priority 1 errors. Bobby Approved status is equivalent to Conformance Level A for the WCAG.
2. *Priority 2 Errors* are secondary access problems. If all items in this section including relevant User Checks passed the test, it meets Conformance Level AA for the WCAG.

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3. *Priority 3 Errors* are third-tier access problems. If all items in this section including relevant User Checks passed the test, it meets Conformance Level AAA for the WCAG.
4. *The Browser Compatibility Errors* are HTML elements and element attributes that are used on the page which are not valid for particular browsers. These elements do not necessarily cause accessibility problems, but users should be aware that the page may not be rendered as expected which may impact usability and accessibility.

As a general rating, Bobby gives the rating with the picture of "Bobby-hats". Hats with wheelchairs indicate Priority 1 accessibility errors that are automatically detectable. A question mark identifies a possible Priority 1 error that cannot be fully automatically checked, indicating that the user will need to address that question manually.

Methodology

Data Collection Method and Analysis

The websites of the top fifty (based on the 2001 college rankings of US-News (2001)) universities were collected and their accessibility and usability evaluated using the two automatic tools (Bobby and Lift respectively). Furthermore, two other performance measures, size and download speed, were determined using Web Site Garage (websitegarage.netscape.com) automatic tool.

To answer the aforementioned two research questions, several statistical analysis techniques are employed. For the first research question, the means and standard deviations of the accessibility and usability ratings of the fifty top university web sites were calculated. To investigate whether, in general, the accessibility and usability are related, bivariate correlation for all analyzed web sites was calculated.

Results and Discussions

Table 1 and 2 list the mean and standard deviation of the usability and accessibility ratings for the fifty top USA universities. Bobby's approval rating is converted into a binary variable with '0' representing 'Not Approved' and '1' representing 'Approved' status. The Usability rating is also converted into an ordinal scale with '1' representing 'Fair', '2' 'Good', and '3' 'Excellent'. The results for web page sizes and download times obtained from web site garage automatic tool are presented in Table 3.

From Table 1 and 2 it is apparent that the web sites of the top USA universities are ranked very low in terms of accessibility (less than 1/3 of them are bobby approved) and low in terms of usability (a rating of 2.16 on a 1 to 3 scale). Table 1 also shows high browser compatibility errors for the university websites. One possible reason for this might be that web site designers tend to rely on web design tools that are compatible with only one particular type of browser.

Nielsen (1997), suggests web sites to have sizes of 8 K for optimum response times (1 second response time) with ISDN connection speeds. From the results on table 3 it can be observed that web sites of the top USA universities on average are more than eight times too big for optimal response time for ISDN users.

	Approval	Priority 1	Priority 2	Priority 3	Browser Errors
Accessibility (Bobby) N=50	0.30 (0.46)	1.00 (0.83)	3.96 (1.11)	1.88 (0.33)	11.84 (5.82)

Table 1: Mean Accessibility Ratings (standard deviations in parenthesis)

	Usability Rating	Catastrophic	Major	Minor
Usability (Lift) N=50	2.16 (0.68)	0.62 (0.81)	2.56 (1.45)	3.44 (1.80)

Table 2: Mean Usability Ratings (standard deviations in parenthesis)

To answer the second research question, bivariate correlation of different usability and accessibility measures were observed. The accessibility approval correlates significantly with the overall usability rating (ρ=0.298, p<0.05). Furthermore, the size of the website was found to correlate highly with usability (ρ=0.442, p<0.01) but not the accessibility ratings. No correlation between the university ranking (USNews, 2001) and either accessibility or usability was found.

Size (KB)	68.34 (26.67)
Download Time (with a 56K modem) in Seconds	18.44 (6.89)

Table 3: Mean web page size and download times (standard deviations in parenthesis)

From the individual university web site evaluations it was possible to segregate sites into three broad accessibility categories

1. High-Accessibility: Sites with no detected Priority 1 accessibility problems. These sites are BOBBY approved.
2. Medium-Accessibility: Sites with one Priority 1 accessibility problem. These sites are not BOBBY approved.
3. Inaccessible: Sites with 2 and above Priority 1 accessibility problems.

Table 4 lists the fifty universities terms of their accessibility rankings based on the three categories defined above.

A qualitative representation of the obtained significant correlation between accessibility and usability is provided in Table 6 Sites listed in Table 5 include only those sites that ranked in the top or bottom tier (Tier 1 or Tier 3, respectively) both in terms of usability and accessibility.

Tier 1 Highly Accessible (Approved)	Tier 2 (Not Approved: 1 P1 error)	Tier 3 (Not Approved: 2 or more P1 errors)
University of California Irvine	Wake Forest University	California Institute of Technology
Univ. of Wisconsin Madison	University of Pennsylvania	College of William and Mary
Massachusetts Inst. of Technology	Stanford University	Yeshiva University
Northwestern University	Georgetown University	Brandeis University
Dartmouth College	Brown University	Georgia Institute of Technology
University of Michigan Ann Arbor	Duke University	Cornell University
Yale University	University of Rochester	U. of North Carolina Chapel Hill
University of Texas Austin	Washington University in St. Louis	Vanderbilt University
University of Washington	Univ. of California Santa Barbara	Carnegie Mellon University
Harvard University	Columbia University	University of California Davis
Boston College	Emory University	University of Chicago
Tufts University	Princeton University	Pepperdine University
University of California Berkeley	New York University	Univ. of Southern California
Univ. of California Los Angeles	University of Notre Dame	
Univ. of California San Diego	Rensselaer Polytechnic Inst.	
	Rice University	
	Johns Hopkins University	
	Pennsylvania State University	
	Lehigh University	
	U. of Illinois Urbana Champaign	
	Tulane University	
	University of Virginia	
	Case Western Reserve Univ.	

Table 4: Three-Tiered Accessibility Ranking of Popular Web Sites

Conclusions

This study aimed to answer two research questions:

1. Are top university web sites rated highly in terms of accessibility and usability?
2. Is the result of accessibility evaluation of university web sites related to the result of their usability evaluation?

The analysis revealed that the web sites of the top 50 USA universities are ranked very low in terms of accessibility (only 30% of them are Bobby approved) and low in terms of usability (a rating of 2.16 on a 1 to 3 scale). The accessibility approval was found to correlate significantly with overall usability ratings for the university web sites.

The legal dimension of making universities (and thus their websites) accessible to people with disabilities should alert the academic community for more careful consideration of incorporating accessibility guidelines in the web site development of their campus websites.

The present study brings about several implications for the practitioners. First, because some web sites' accessibility and usability measures are not predictive of each other, it opens a door into exploring the possibility of developing an integrated automated accessibility and usability evaluation tool. Second, the finding that most web sites did not receive the approved status from Bobby could be used to motivate web site designers to improve the accessibility and usability of web sites.

Further research could be conducted in several areas. First, in this study, only simple correlation and descriptive statistics were employed. Advanced statistical analysis such as structural equation modeling would be fruitful to explore the underlying relationship between different measures of usability and accessibility evaluation.

Tier 1 Highly Usable (LIFT: Good)	Tier 2 (LIFT: Fair)	Tier 3 Least Usable (LIFT: Poor)
Pennsylvania State University	Univ. of California Santa Barbara	Brandeis University
Yale University	University of Rochester	Univ. of Southern California
Harvard University	Tulane University	University of California Davis
Boston College	Dartmouth College	U. of Illinois Urbana Champaign
Georgetown University	Carnegie Mellon University	Pepperdine University
Lehigh University	Brown University	Yeshiva University
California Institute of Technology	Stanford University	Emory University
Case Western Reserve Univ.	Rensselaer Polytechnic Inst.	Cornell University
University of California Irvine	Duke University	
University of Texas Austin	New York University	
Wake Forest University	Princeton University	
University of Notre Dame	Massachusetts Inst. of Technology	
Rice University	Tufts University	
Columbia University	Northwestern University	
University of Michigan Ann Arbor	University of Pennsylvania	
Johns Hopkins University	University of California Berkeley	
Univ. of California Los Angeles	University of Washington	
	U. of North Carolina Chapel Hill	
	Washington University in St. Louis	
	College of William and Mary	
	Univ. of California San Diego	
	Georgia Institute of Technology	
	Univ. of Wisconsin Madison	
	University of Chicago	
	University of Virginia	
	Vanderbilt University	

Table 5: Three-Tiered Usability Ranking of Popular Web Sites

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Second, in the present study, the topic of interest is university web sites. However, the methodology used in this paper could be applied in any area of interest (e.g. entertainment, e-commerce or, services).

Some limitations of using automatic evaluation tools need to be recognized:

1. There are important elements (such as the web navigation structure, the information's layout, the value of information, or various aesthetic aspects) which are not evaluated by the automatic tools.
2. The meaning/significance/appearance of graphics is not evaluated, only the inclusion of ALT tags are taken into consideration by Bobby and LIFT and only the number (higher number of graphics correlates to lower rating) of graphics is considered in LIFT.
3. Text-only web sites will get high ranking with both tools regardless of the quality of information or the readability of the fonts.

These limitations might imply that, although automatic evaluation tools provide a quick reference of the web site's accessibility and usability, formal usability evaluation involving user testing combined with a series of other non-empirical methods (such as cognitive walkthroughs or GOMS) still hold a major importance in the thoroughness of web site evaluation.

High Usability/Accessibility	Low Usability/Accessibility
University of California Irvine	Brandeis University
University of Michigan Ann Arbor	Univ. of Southern California
Yale University	University of California Davis
University of Texas Austin	Pepperdine University
Harvard University	Yeshiva University
Boston College	Cornell University
Univ. of California Los Angeles	

Table 6: Concordance/Discordance Summary of Sites on Usability and Accessibility

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User-Centered Evaluation of an On-Line Modern Greek Language Course

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Abstract: In this paper, a set of user-centered evaluation methods, used to construct a richer conception of the audience of an online Modern Greek online course, are presented. First an analysis of the design methodology employed in this specific case study is provided and then examples of how valuable usability information can be extracted from different user-center evaluation methods is presented. Conclusions, related to the analysis of the information obtained through the different evaluation methods and about the usability of the course, are also provided.

Introduction

Learn Greek online

Kypros-Net, Inc. is a not-for-profit organization that provides information on-line about the island of Cyprus, including news, history, culture, etc. Its web site (http://www.kypros.org) receives about 1 million hits per week (and around 40,000 unique visitors per day). One of its services is an online course for learning Greek. The course includes 105 audio lessons with corresponding notes, a Greek-English-Greek dictionary, and a spellchecker. In addition, a section of the site's discussion board is dedicated to student questions about the course.

The Greek on-line course content evolved gradually over three years. Based initially on 105 (around 20 minutes each) digitized lessons it gradually developed into a complete Greek Language course. The web site was developed by the Kypros-net team in 1998. The site was designed to encourage student participation in its subsequent development (Participatory Design).

Design Approach

Our focus has been to design an online learning community. We believed that this online interaction and community would increase our users' motivation, commitment and satisfaction with the online course. The Participatory Design (PD) methodology blends nicely with our goal. In particular, involving users during system development is thought to lead to greater user commitment, acceptance, usage, and satisfaction with the system (Baroudi et al., 1986).

In the design phase of the on-line Greek language course, we implemented PD as a four-step process (Blomberg & Henderson, 1990, Ellis et al., 1998, Zaphiris & Zacharia, 2001), each corresponding to one of the four levels of the classical spiral software engineering development (Boehm, 1987) model (Fig. 1)

a) Building bridges with the intended users. This step opened lines of communication between intended users and the development team. Specifically this step involved the initialization of a multidisciplinary development team, identifying key groups of end users, and creating new methods of communication with users. The development team came out of the Kypros-Net Inc. (http://www.kypros.org/) group. Through their involvement in Cyprus and Greece related projects, they had longstanding relations with the intended user community.

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The intended users have been especially people of the Greek Diaspora, travelers to Cyprus and Greece and other Greek speaking areas and people who are generally interested in the Greek culture and language or languages in general. In our case bridges with the intended users were build through our years of work at providing information about Cyprus through the web pages of Kypros-Net, Inc. who primarily attracts the same user population as our intended Greek language online course.

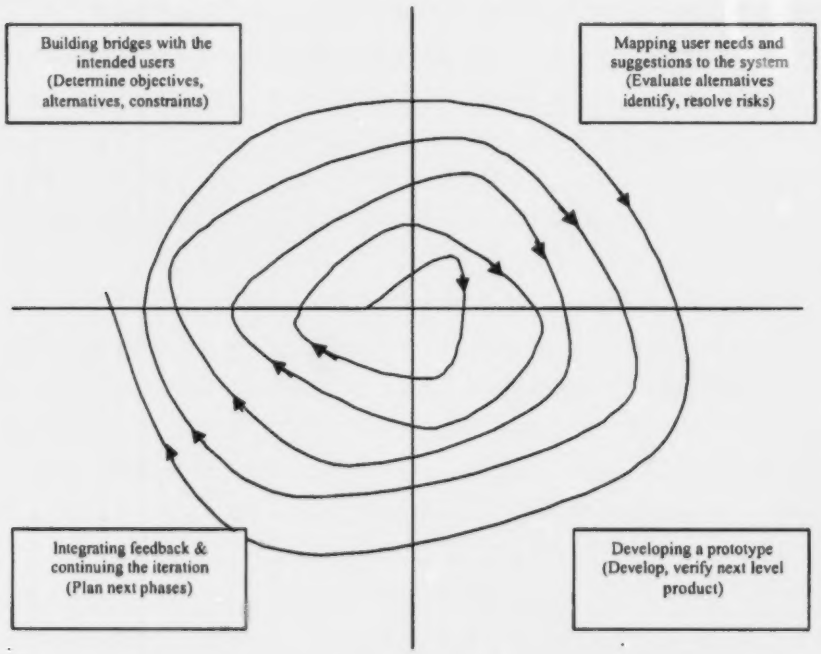
Building bridges with the intended users (Determine objectives, alternatives, constraints)
Mapping user needs and suggestions to the system (Evaluate alternatives identify, resolve risks)
Integrating feedback & continuing the iteration (Plan next phases)
Developing a prototype (Develop, verify next level product)

Figure 1: The participatory design methodology employed in this project. In parenthesis the corresponding levels of the classical spiral design methodology.

b) Mapping user needs and suggestions to the system. Our conceptual design model has been "to design an online effective Greek language course that can build and sustain an online learning community of students". Based on the questions and inquiries we received from our users we tried to match their needs (they wanted an easy to follow, both elementary and advanced course that they could attend at their own paste) with our conceptual design model.

c) Developing a prototype. The project consists of 105 audio files, which were originally recorded as Radio lessons in Modern Greek for English speakers back in 1960's. The lessons were retrieved from the archives of the Cyprus Broadcasting Corporation, digitized in Real Audio 5.0 format and published on-line. Although, an optional textbook accompanied the original Radio lessons, the lessons were designed as a complete standalone course. We used several tools to assist the students of the lessons, including an online English-Greek-English dictionary, a Greek spell checker and a web-based discussion board for the students of the lessons.

d) Integrating feedback and continuing the iteration. Feedback from our users and suggestions are continuously incorporated into our design through a series of additions and corrections. At some point, the users started exchanging through email written notes taken by the advanced users. This phenomenon suggested that we should provide the users with the capability to post their notes on the project's site. Users have also compiled lists of verbs and vocabulary words used in the Audio Lessons, and other grammatical notes. Recently users have been involved in groups that design and post quizzes for their classmates. Furthermore, a user has developed (and made it available online for free) a palm-pilot version of the dictionary.

User-Centered Evaluation Methodology

Many aspects of usability can best be studied by simply asking the users. This is especially true for issues related to the users' subjective satisfaction and possible anxieties (Nielsen, 1993).

Since the course is highly dependent on user participation, the design team from the beginning has taken steps in collecting and analyzing user feedback. Evaluation of the course has been from the beginning an integral part of our Participatory Design implementation. First, a questionnaire was provided for collecting feedback about the general usability of the course. Secondly a discussion board was created where users could post their questions and comments and finally an email address was provided through which users could contact the design team.

Questionnaire and Discussion Board postings Evaluation

One hundred and eighty one students, taking the online 'Learn Greek Online' course responded to an online questionnaire assessing the overall usability of the course. The questionnaire was based on the Computer System Usability Questionnaire (CSUQ) (Lewis, 1995) and was administered through the web-based user interface evaluation with questionnaires system provided online by Gary Perlman (http://www.acm.org/~perlman/question.html). CSUQ consists of nineteen usability questions to which the respondent was to agree or disagree on a five point scale, ranging from 2 (Agree) to –2 (Disagree).

Table 1 shows the overall ratings for the online course for the individual questionnaire questions. A graphical representation of the results is provided in Figure 2. Next the responses to all questions were combined together and the average overall ratings was plotted in Figure 3.

In addition to the questionnaire, we analyzed a total of 371 postings (posted online from December 1998 to March 2000). After a first careful reading of the 371 postings five main categories were identified: (1) Technical related questions and instructions related to technical questions, (2) Content related issues, like spelling, grammar and syntax, (3) Resources and Notes related postings, (4) Miscellaneous.

Then we conducted a more elaborate study and categorization was performed looking into nine subcategories of the four main categories based on the technical actions necessary to improve on each one of the categories. Table 2 shows the frequency of postings for each subcategory.

	Question	Rating
Q1	Overall, I am satisfied with how easy it is to use this online course.	1.40 (1.14)
Q2	It was simple to use this online course.	1.40 (1.13)
Q3	I can effectively complete my work using this online course.	1.20 (1.22)
Q4	I am able to complete my work quickly using this online course.	1.05 (1.27)
Q5	I am able to efficiently complete my work using this online course.	1.10 (1.24)
Q6	I feel comfortable using this online course.	1.49 (1.07)
Q7	It was easy to learn to use this online course.	1.37 (1.15)
Q8	I believe I became productive quickly using this online course.	1.19 (1.17)
Q9	The online course gives error messages that clearly tell me how to fix problems.	0.13 (1.60)
Q10	Whenever I make a mistake using the online course, I recover easily and quickly.	0.81 (1.29)
Q11	The information (such as help, on screen messages and other documentation) provided with this online course is clear.	0.89 (1.34)
Q12	It is easy to find the information I needed.	0.83 (1.37)
Q13	The information provided for the online course is easy to understand.	1.24 (1.07)
Q14	The information is effective in helping me complete the tasks and scenarios.	1.19 (1.06)
Q15	The organization of information on the online course screens is clear.	1.20 (1.23)
Q16	The interface of this online course is pleasant.	1.30 (1.12)
Q17	I like using the interface of this online course.	1.23 (1.17)
Q18	This online course has all the functions and capabilities I expect it to have.	0.99 (1.30)
Q19	Overall, I am satisfied with this online course.	1.40 (1.06)

Table 1: Mean user ratings with standard deviation in parenthesis

In addition to the nineteen questions, users were also encouraged to provide feedback by listing up to three of the most positive and up to three of the most negative aspects of the online course.

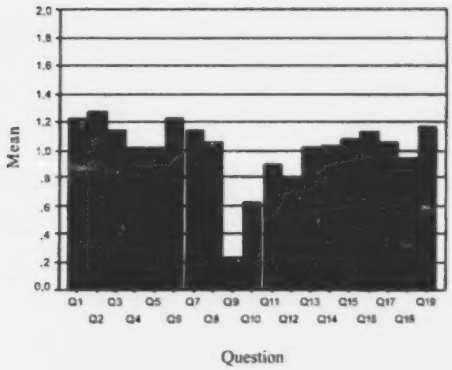

Figure 2: Plot of mean user ratings for the 19 questions

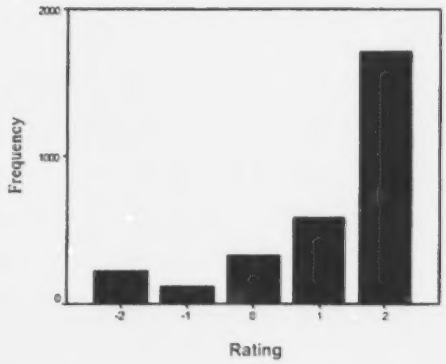

Figure 3: Overall Usability Ratings for the course

Category	*Subject*	*N*	*%*
Tech/Instructions	Problems with needing/installing Greek drivers and fonts	56	15.1
	Problem with/wanting to download lessons	49	13.2
	Problems with installing/using RealPlayer	40	10.8
Content	Questions about vocabulary	28	7.5
	Questions about grammar/spelling	17	4.6
	Questions about dialect	2	0.5
Resources	Questions about availability of text, CDs or including links to web sites.	37	10.0
Notes related questions	On-line notes	73	19.7
Miscellaneous	Miscellaneous	69	18.6

Table 2: Frequency of postings per subcategory of usability issues.

Analysis of Server Logs

The data described below are taken from the cumulative log file record, a 590-megabyte corpus, for a 30-month period from July 19, 1998, when the learn Greek online project was officially "launched," through December 31, 2000. The project is a unique complete online course of the modern Greek language and has been extensively promoted on the internet and by the Cyprus Broadcasting Corporation on local Cyprus radio and television.

Total number of successful hits	3,704,104
Total number of user sessions (visits)	1,256,770
Distinct Users	900,481
Average hits per day	4061
Average user sessions per day	1378
Average user session length	0.47 minutes
Average number of documents examined per user	2.55

Table 3 Access statistics for the course: July 19, 1988 to December 31, 2000.

These logs, in the extended log file format, keep track of who was visiting the site (unique internet addresses), when they came, what they requested, how long they looked at each page, where they were before they came to the site, what browser they were using, what country they were from, and more. Log files were analyzed using wusage (http://www.wusage.com). Table 3 represents the overall access statistics for the 30-month period.

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Site Traffic. Traffic to the site peaked following the addition of each new item and any publicity campaign, then tapered off considerably during the late spring and early summer, probably in correspondence with the academic calendar, and then picked up and resumed a state of about 1378 user sessions per day. (User sessions are defined as a sequence of HTTP requests from a unique user, as determined by internet protocol address. Sessions are considered to have terminated if there are no requests for a 30-minute period.) During the 30-month period, there were an estimated 1,256,770 user sessions, lasting an average of 0.47 minutes with the longest lasting 174 minutes. Sessions were split roughly equally between daytime (8:00 a.m. – 6:00 p.m., user's local time) and evenings (6:00p.m. –8:00a.m., user's local time). There were 46.7% of sessions in the daytime and 53.3% in the evenings.

Requests for Site Features. With respect to features of the site that were accessed, 25.61% of the hits were caused from accesses to the Greek-English-Greek dictionary associated with the course indicating a substantial usage of this tool by the students of this course or even by visitors that are not regular users of the rest of the items of the online course, this is further supported by the fact that over 40% of users enter the site through the dictionary section. The main course page attracted 13.71% of the accesses. From the individual audio lessons, it can be observed that lesson one runs high (6.43%) whereas the rest of the lessons received accesses below 1% of the total, this shows to us that a lot of visitors to the kypros-net website show interest in investigating the course (by listening for a few minutes the first audio file) although they might not be interested in taking the course (for example they might already know enough Greek, they might be interested to know that such a course exists but they don't have time to learn Greek right now etc.)

Users' Software Profile. The server log analysis enables us to detect the software (browser and operating system) that our user population uses when accessing our site. The majority of our users uses Microsoft Internet Explorer as their browser (41.5% MSIE 5, 20.8% MSIE 4) with Netscape coming second (10% Netscape 4). In terms of operating system Windows 98 comes first with 30% of visits and Windows 95 second with 20% of visits.

Referrer Log Entries. Analysis of the referrer log data suggests that most of the traffic that did not come as a direct result of one of the links on the Kypros-Net other pages arrived at the course website from a net guide or search engine. For instance, more than 130,000 accesses came from yahoo, 13,962 from msn, 13,346 from altavista and 8,551 from google. The keywords that most frequently brought visitors to the site were "greek dictionary", "greek language" and "greek translation" again showing a high popularity for the dictionary of the course.

Discussion - Conclusions

The results of the questionnaire provide valuable suggestions to the design team of the online Modern Greek course.

The course ranks high in terms usability (Fig. 3) with the majority of the respondents rating all nineteen questions high. When combining all responses to all questions together we get an average overall rating for usability of the course of 1.53 (S.D.= 1.23) with the majority of responses (57.6% of 2974 valid data points) being the highest score of two. Only 11.9% (7.7% gave scores of –2 and 4.2% gave scores of –1) of responses were below zero.

Although the course ranks high in terms of usability the analysis does signal a need for improvement of the course. When looking at the individual questions rankings one can see that question 9 (The online course gives error messages that clearly tell me how to fix problems),question 10 (Whenever I make a mistake using the online.course, I recover easily and quickly), question 11 (The information (such as help, on screen messages and other documentation) provided with this online course is clear) are all related to help and error messages and are all ranked low (below 1.0) when compared to the other ranking questions.

This suggests that users need better feedback from the interface and there has to be better source of suggestions for solutions to errors they encountered. Relating this further to the content of the course, it can be concluded that when users for example get error messages from the real audio player (such as network congestion) they are left wondering what this implies and how and if they could correct it.

Another interesting result is the comparatively low ratings for question 12 (It is easy to find the information I needed). This might suggest a more careful re-design of the information architecture of the course with clearer indications where users can find the different material.

On the other hand users give the highest rankings to question 1 (Overall, I am satisfied with how easy it is to use this online course), question 2 (It was simple to use this online course) and question 19 (Overall, I am satisfied with this online course) showing a high overall satisfaction of users with the online course and its ease of use.

Feedback was also solicited in the form of asking the users to list the most positive and most negative aspects of the course. Looking at those results, it can be seen that students consider the course easy to learn and fun. On the other hand they point out technical problems (especially with the audio streaming) and pedagogical issues (no instructor, no tests) as the most negative aspects of the online course. The design team of the online course can use this as a valuable source of suggestions for future re-designs. For example, better ways of streaming the audio should be investigated; possibilities of including academics involved in teaching Modern Greek in the online community should be explored

Besides the insights derived from the user questionnaire, we were able to identify additional usability issues from the postings of the users on the discussion board of the course. As we can see from Table 3, the users had additional usability problems, like the lack of technical related instructions. The design team responded by adding links to external resources or actual instructions in the appropriate sections of the course.

Furthermore valuable usability conclusions (what sections are most popular, what software our users are using) can be drawn through the analysis of the server log.

Our evaluation methodology has been from the beginning designed to be in two parts. The results presented in this paper, are the results of the first stage of our user-centered evaluation. Our first stage (as can be seen on this paper) was focused primarily on content related evaluation. We focused on receiving feedback that will give us enough information to know whether our content is sufficient and of high quality. In our second user-centered evaluation stage (currently in progress) we are primarily focusing, apart from further usability evaluation, on the pedagogical strength of our course. More specifically, users have volunteered and are currently involved in groups that develop quizzes for each lesson of the course. We strongly believe that the results of those quizzes will give us enough information to judge whether our course is pedagogically successful. Furthermore we are currently administrating a new online questionnaire (consisting of 3 individual stages) to quantitatively evaluate user satisfaction and course usability. We have already collected more than 5000 completed questionnaires and we will be presenting the results in a follow up publication. Furthermore our team is currently involved in qualitatively analyzing further the interaction among students of this course, this will be done by using Social Network Analysis to further analyze the online community of our discussion board.

Future research on this specific case study can include heuristic evaluation of the course, survey and interviews with representative users, and finally a formal usability test on specific tasks with real users.

Those who wish to study traditional courses have accurate information about their audience from class listings, interviews and surveys. Creators of on-line courses have digital counterparts to these measures. In this paper, we attempted to outline some methods we used to construct a richer conception of the audience of the "Learn Greek Online" course.

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Panel on Special Topics of Web Usability

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Abstract: Special web usability issues, like senior-centered design and cultural considerations when providing information on the web, are getting more and more attention from the design and academic community. Furthermore, new applications (especially e-learning) are gaining more and more popularity and create new opportunities but also new challenges for the design community. The objectives of this panel are: (1) To briefly introduce the general topic of web usability, (2) To present a selection of special issues related to the general topic of web usability (3) To become a forum for open discussion on these topics among the WebNet community.

1. Position of Panayiotis Zaphiris (Web Usability)

Usability of a product or system – whether a web site, software application, mobile technology or any user-operated device can be defined as "a measure of the ease with which a system can be learned or used, its safety, effectiveness and efficiency, and attitude of its users towards it." (Preece et al., 1994)

In other words Usability is a combination of factors that affect the user's experience with the product or system, including (http://www.usability.gov) :

1. Ease of learning: How fast can a user who has never seen the user interface before learn it sufficiently well to accomplish basic tasks? Once an experienced user has learned to use the system, how fast can he or she accomplish tasks?
2. Memorability: If a user has used the system before, can he or she remember enough to use it effectively the next time or does the user have to start over again learning everything?
3. Error frequency and severity: How often do users make errors while using the system, how serious are these errors and how do users recover from these errors?
4. Subjective satisfaction: How much does the user like using the system?

Through out the years a series of methodologies have been developed for achieving a user-centered design that can achieve the design of usable, effective and efficient to use products. Also a series of methods and tools have been developed to qualitatively and quantitatively measure the usability of these products and services.

Furthermore, these methodologies have recently been adopted or modified and applied to web usability studies. Focus groups, heuristics, log data analysis, questionnaires, formal usability tests have all been extensively adopted and used in usability evaluations of web sites.

But, although usability advocates (like Jackob Nielsen) believe that "usability rules the web" (Nielsen, 2000) studies typically find a usability success rate of less than 50%.

What needs to further be done? What new techniques and methods might be necessary to enhance the current usability testing methodologies? What about the non-traditional issues surrounding the web? Are cultural issues and issues of internationalization important when it comes to web design? What about seniors or people with disabilities that try to access information on the web? Is the web accessible to these groups of people? Are our e-learning methodologies and applications usable? What do we need to have in mind when we decide to move our course or training online?

2. Position by Jantawan Noiwan (The Impact of Culture in Designing Web-Based Systems)

The exponential growth of Web sites and Internet users could be considered as a significant phenomenon in information technology throughout the world. The Internet as the global communication channel allows buyers and sellers who have different cultural backgrounds and speak different languages to interact with each other. Therefore, undoubtedly, electronic commerce on the Internet significantly boosts profitability and productivity of worldwide companies. Accumulated survey data from plenty sources sheds light on possibilities of strong competition among ecommerce businesses to reach through the huge number of international Internet users.

The success of e-commerce could depend on the effectiveness of managing cultural differences of users from different parts of the world. Internationalization and localization are the two opposing concepts in applying cultural factors into interface design. Both internationalizing and localizing Web sites to customers in each particular culture have advantages and disadvantages; internationalizing or standardizing can reduce costs, but localizing can better serve the needs of customers in particular cultures, regions, or languages.

Culture has been differently defined across areas of study (e.g., anthropology, cognitive psychology, sociology, information technology management, and organizational management). Generally, culture differs not only in language, symbol, image, color, and format of date and time, but also emotion, personality, perception, cognition, and thinking style.

To localize an interface by taking cultural factors into account must be considered with care. Several HCI researchers are currently exploring many aspects of culture that can influence interface design. However, cultural studies in HCI are still very limited. Basically, general guidelines of cross-cultural interface design and general models of cultural differences might be adapted for interface design purposes, thereby improving in user performance and user satisfaction.

The panel attempts to discuss the efforts of HCI researchers in understanding cultural impacts in human information system. Developing successful computer interfaces, either for software or Web sites, require careful considerations on language translation and implications of culturally sensitive elements. Ignoring cultural issues, to make interfaces standard for all users around the world might not be a right solution. Rather, such interfaces should be designed to fit with intuitive usability in representational, cognitive, and attitudinal aspects of users in each particular culture, since users from different countries not only speak different languages, but also have different cultures that make them process information, think, feel and act differently.

Most of cultural issues in HCI are related to representations of interface elements such as colors, languages, icons, symbols and images. Environment and culture shape humans' perceptual practices. In recent years, most of the empirical studies with regard to the design of cross-cultural interface attempt to examine the question of whether cultural diversity affects visual perceptions. For instance, color connotations convey different meanings from culture to culture; red means happiness in China but means death in Egypt. Misinterpretation of the meanings of these culturally sensitive elements could reduce user performance and satisfaction. The results might be even worse with users who have an external locus of control. This characteristic is found in cultures that have high uncertainty-avoidance. Such users tend to believe that they cannot control the situation they face (e.g., computer operation) and tend to be fearful of doing things wrong.

Other than studies of culturally representational aspects in interface design, some culturally cognitive studies have been investigated such as menu interface design. Apparently, researchers and practitioners could not deny that human cognitive processes vary across cultures. Most of studies in culturally cognitive aspects are comparatively conducted between Chinese and American subjects.

To measure how users perform and how they think about the system are equally important. Similar to user performance, user attitudes or judgments in experiencing the system are different across individuals, which affect how users use the system in the later time. Culture plays an important role in shaping and influencing how users think and feel toward a stimulus. HCI researchers points out that studies on feelings, values, tastes and beliefs that could influence human interaction with computer technologies should be investigated. A number of information system studies measure user attitudes toward computer technology in relationship to cultural diversity. In cultural interface design, however, very few empirical studies have been explored subjective interface evaluation. Most of such studies are related to interface aesthetics.

3. Position by Sri H. Kurniawan (Universal Usability: Improving Online Information Usability for Older People and People with Disabilities)

Previous studies showed that users have various problem in utilizing the information effectively when the user group is not represented in the design team, which is often the case with web information for older users and users with disabilities. The purpose of this panel is to view usability problems commonly faced by older users and users with disabilities and ways to improve the usability of online information usability for these users.

By the year 2030 people aged 65 and above will represent 20% of US population (U.S. Census Bureau, 2000). Older adults are also a rapidly growing segment of the online user population. Until recently, older adults have been underrepresented as Internet users, but the most generous recent estimates conclude that seniors represent 13% of online users (Cury, 2001).

The number of seniors online is expected to increase with the aging of the more computer-literate baby-boomer population. This significant increase in the older computer user population has led to various studies investigating the age effect in utilizing the Web. Some findings suggested that older adults have some disadvantages in fully utilizing the Internet as an information source. That is, older people have more trouble finding information in a Web site than younger people (Mead et al., 1997). However, little effort has been placed to ensure that online information is structured to help older computer users to find the desired information easily and efficiently.

With more and more information and services available for public over the Internet, it is imperative that no element of society be left out. The World Health Organization estimates that seven to ten percents of the world's population are disabled, either physically or cognitively (WHO, 1999). People with disabilities are supposed to be offered unprecedented opportunities to access information and services over the Internet, because people with disabilities for the most part use the Internet in the same way everyone else does.

Much of the base work on web accessibility (simply called the Web Content Accessibility Guidelines or WCAG) has been initiated by the international organization W3C. For the past several years W3C has researched, codified, and encouraged people to make their Web sites accessible. W3C also produced guidelines to help create accessible Web sites and continued to conduct research into how to make Web sites accessible.

More and more automatic tools are available on the Internet for web site designers to ensure the accessibility and usability of their web sites, such as: Bobby, ..., Netmechanic, etc. These tools are mostly free, enabling any designers to take advantage of them.

Although it seems that the legal and mandates of web accessibility of information resources, studies reviewing the accessibility and usability of online information for people with disabilities showed that the majority of online information still does not truly pay too much attention in information accessibility and usability.

4. Position by Athanasios Karoulis (The Adaptation of the Traditional Open and Distance Learning (ODL) Environments to the Web Concerning their Usability)

It seems that it is now the time for the worldwide acceptance and establishment of Open and Distance Learning (ODL). Its roots can be found in the industrial age, where economics started to accelerate and have spread to reach nowadays the information-based economy and globalization, where information is already the fourth productivity component together with the nature, the labor and the capital. Meanwhile, new terms have emerged, like *specialization, knowledgeable workers, continuous education*, and *life-long learning*. Obviously, the traditional methods offered by common schools and universities, could no more help in this direction, so ODL was born.

On the other hand the continuing technological evolution supported the parallel emergence of technology-based distance learning environments, known nowadays as e-learning environments. They can be considered to be a subset of ODL, so they have to follow the basic axioms and the philosophy of ODL. This is the first core issue this presentation focuses on, namdy the adaptation of the philosophy of ODL to web-based e-learning environments. In particular, what was the usability in general of the traditional ODL environments and how it is going to be transformed to the new e-learning ones without to confront to the axioms of ODL?

The birth of the Internet emerged a shift to the way we all work and communicate. The web supports two tasks simultaneously: to store and deliver information and to facilitate communication between the participants. Also, a major point of concern in this new medium is its usability. Factors, such as the download time are only the top of the iceberg. Moreover, the notion of the interaction between user and system is fully integrated in the essence of the web, yet many add-ons, plug-ins and aiding technologies are needed in order to realize it. Is their existence a facilitation or an impairment of web-usability? Do we characterize the contemporary state of the web as «usable» at all? Moreover, if we adapt this question to e-learning environments, in combination to the dual-nature of the Internet, we come up on two separate questions:

Is the storage and delivery of the educational information in contemporary e-learning environments usable? What must be done and what can't be done? What are the future trends?

Is the offered communication channel of the contemporary e-learning environments usable? How was it utilized in the traditional ODL environments, and how is it going to be transformed in the e-learning environments? What does it misses, and where does it make overuse? What was its usability how is it now, and how should it be redefined (if it should at all)?

These questions can be combined in their turn to one resultant question:

Is such an educational environment acceptable at all? In other words, does it rely on the correct educational theory, or is it just about the materialization of the front-end technologies in a, so-called, educational environment? How can one distinguish an effective elearning environment, and what are its main characteristics?

This question leads in its turn to the notion of «lernability», which emerged recently in the relative literature. What are the points of concern for an e-learning environment to facilitate the acquisition of knowledge? It seems that we must consider the usability of the educational interface and the learnability of the educational context of the environment together, in other words to study the combination of these two factors. How exactly do they complex? Does usability influence learnability at all, and vice-versa?

At this point of this panel we shall try to summarize the most recent results from relevant studies, and investigate in how far they can guide the design of a contemporary e-learning environment.

In conclusion, the objective of this part of the panel is to clarify the framework in which e-learning environments must perform, concerning their usability and learnability. This framework involves parameters, such as the theoretical and instructional background, on which the environment bases, the communication channel and its materialization, the information content and context of the environment and, finally, to conclude on the notions of the usability and the learnability of the environment.

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Chinese Language Acquisition Made Easy: a Multimedia Web-based Comprehension & Learning Tool

Extended Abstract for a Short Paper
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1 Background and Objectives of the Presentation

In modern FLA (Foreign Language Acquisition), the use of software tools can simplify the teaching and learning processes involved. More than that, analytic software tools such as on-line dictionaries employing a real-time tool tip lookup on electronic foreign-language text enable web surfers to understand the content of foreign-language web pages with minimum effort. Especially valuable for language users and learners alike is the Text-To-Speech component of a foreign-language comprehension web tool, as it allows highlighting any portion of the foreign-language web text – a word, sentence, paragraph or entire article – and have it read aloud through the sound system of the computer. The comprehension tool thus becomes a learning tool, allowing the web surfer to analyze the foreign-language text in its various formal-linguistic and semantic dimensions – understanding the meaning and at the same time learning the language.

In my work as a researcher and teacher involved in SLA/FLA (English and Chinese), I have made extensive use of interactive multimedia computer technology, both in the writing of teaching materials and in language teaching itself. Guiding Canadian students of the Chinese language to use software tools for independently working on Chinese web text has brought multiple benefits to students and teachers. To mention only a few: at a very early stage, the students could choose a topic of their liking on the Chinese web, and read it with the help of the software; thus the learning process became more efficient, and instead of pre-fabricated lessons from textbooks. Using the web in its authenticity as a textbook enabled the students to learn both the linguistic aspects of the foreign language and its sociocultural context. Another advantage was that the teachers could devote more time and effort to the next level of language issues, such as real-world language use and language socialization.

Among the software programs available for writing/reading of Chinese texts in electronic format, the KEY software (www.cjkware.com) stands out for its unique design as a multimedia reading comprehension and learning tool for the Chinese language. In the hands of the modern language teacher who makes full use of today's information technology, this software enables even beginners to independently develop a reading and listening comprehension of Chinese web texts. Through its analytic capabilities, through its linguistic infrastructure, can

- Allow teachers of a foreign language delegate the more mechanical functions of language learning to the computer;
- Open the door to information that is written in a foreign language (in our case Chinese) for anyone;
- Help language learners to acquire reading and listening comprehension in a foreign language (in our case Chinese);
- Act as the key to reading comprehension of foreign language text (in our case Chinese text) on the web.

2 Description of the Software Tool

Originally conceived as a Chinese word processor for Windows 95/98/2000/NT, the KEY software includes features that make it an analytic tool for comprehending Chinese text in electronic format. These features are:

- "Linguistic Reconstruction" of Chinese text from electronic text sources, such as the Internet. A "word" in a modern Chinese text can be formed of one, two, three or more Chinese characters; the word boundaries are not indicated in a Chinese text, but the reader has to infer them from context. In case of electronic text on the computer, to be able to display the meaning of, let's say, a Chinese word consisting of 3 characters, the text is automatically segmented by the software, and the 3-character word is actually recognized as a compound.
- The on-line Chinese – English dictionary of 240,000 terms. Hovering the mouse pointer for a short moment over a Chinese word in a linguistically reconstructed text shows the pronunciation of the word in its Pinyin Romanization, as well as the English equivalents of the Chinese word, using the "tool tip" display technique. Thus, dictionary lookup and display of the lexical equivalent is fully automatic, without clicking or keyboard action.
- The TTS (Text To Speech module). Highlighting a text passage in a linguistically reconstructed Chinese text and clicking the "TTS" button on the toolbar makes the sound system read the selected passage in standard Mandarin.
- If desired, the software automatically adds another line (above, or below) to the Chinese character text line, containing the Pinyin Romanization with automatically added tone marks: transcribing Chinese correctly in Pinyin requires the tone mark diacritics, which are an integral part of the Pinyin Romanization system. For us-

ers in Taiwan, a second line with the automatic transcription of the selected text in the "Chinese National Alphabet" (zhuyin fuhao) can be added.

3 The Process of Using the Software as an Analytic Tool

During the presentation of this paper I briefly demonstrate the use of the software by analyzing an authentic Chinese text that is randomly taken from the Internet. We start by going to a Chinese web page and copy/paste the Chinese text we want to read into the KEY edit window.

- FIRST ANALYTIC STEP: ADDING A LINE OF PINYIN. To get a "Pinyin with tone marks" line along the Chinese character text, we select (highlight) the entire text in KEY ("Select All" on the Edit menu). On the Format menu, we click "Hanzi with Pinyin" and check the item "Hanzi with Pinyin". A line with the Pinyin version of our Chinese text appears. Through its linguistic infrastructure, the Chinese text system has provided the imported text with the correct word boundaries.
- SECOND ANALYTIC STEP: CHINESE - ENGLISH DICTIONARY LOOKUP. To get the English meaning of the text, we move the mouse pointer slowly along the Chinese character text, which will display a tool tip window with the pronunciation, the radical / stroke data of the word(s) being looked up, and the English meaning. In the text, the word boundaries of the terms that are being looked up are clearly marked with each lookup, through highlighting in yellow.
- FOURTH ANALYTIC STEP: LISTEN TO THE TEXT IN SPOKEN MANDARIN. We highlight the text portions we want to hear spoken in Mandarin and click on the "TTS" button on the toolbar. The highlighted text is read through the multimedia system of the computer, in a natural human voice. The tone sandhi occurring when reading Chinese text is implemented in the Text To Speech rendering.

4 Summary of Benefits Using analytic software tools in SLA

The IT-oriented teacher of a foreign language can use software as an analytic tool for Internet-based language learning, and as an authoring system for creating multimedia lessons. The benefits to users of this method are both obvious and significant:

- No more rote learning of vocabulary: vocabulary is acquired within its authentic context;
- Even at an early stage in their language learning program, students can choose a foreign language website with their topic of interest and use the software as a learning tool;
- Specifically for Chinese: the gap existing in the written Chinese language between traditional characters (used in Hong Kong, Taiwan, overseas Chinese communities) and simplified Chinese characters (used in Mainland China and Singapore) is automatically bridged: the software allows the reader to toggle Chinese text between the two different display modes;
- Readers and students at all levels (beginner to advanced) are enabled to read foreign language newspapers and magazines on the Internet, without dictionary lookup work: the lexical equivalents of words are displayed automatically while sliding the mouse pointer along the text;
- Readers and students at all levels (beginner to advanced) can highlight a text passage and request from the system to read the passage aloud in the foreign language; thus, a foreign language text in electronic format, such as web text, can be analyzed and understood, as if a tutor were always beside the reader / student.

5 Intended Audience of my Short Paper

- Anyone interested in computer-assisted language learning (CALL)
- Anyone interested in how to learn and teach Chinese with the help of IT
- Anyone interested in Internet-based language learning strategies.

No special prerequisites are necessary for understanding this presentation.

Multimedia Software Tools that Give Access to the Chinese/ Japanese web

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This poster/demonstration shows how the use of software tools can greatly facilitate the comprehension of Chinese / Japanese web text, and the acquisition of these languages. Web-based software tools can: Help the foreign language teacher delegate the more mechanical functions of language learning to the computer, Open the door to information that is written in a foreign language, Assist language learners to acquire reading and listening comprehension in a foreign language, and Play a key role in reading foreign language text on the Internet. In the course of this poster/demonstration, the use of the KEY Chinese / Japanese software tool is demonstrated on an authentic Chinese text from the web. The main analytic capabilities of the software tool are demonstrated, which include (a) linguistic reconstruction of the Chinese web text regarding word boundaries, (b) automatically generating the "Pinyin with tone marks" equivalent of the Chinese character web text on a parallel line, (c) "tool tip" dictionary lookup on the Chinese web text for comprehending the meaning, and (d) activating the TTS (Text To Speech) component for reading the Chinese web text aloud in standard Mandarin Chinese through the computer's multimedia system.

XML Based Scientific Data Management Facility

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Abstract: The World Wide Web consortium has developed an Extensible Markup Language (XML) to support the building of better information management infrastructures. The scientific computing community realizing the benefits of XML has designed markup languages for scientific data. In this paper, we propose a *XML* based scientific *data management facility, XDMF*. The project is motivated by the fact that even though a lot of scientific data is being generated, it is not being shared because of lack of standards and infrastructure support for discovering and transforming the data. The proposed data management facility can be used to discover the scientific data itself, the transformation functions, and also for applying the required transformations. We have built a prototype system of the proposed data management facility that can work on different platforms. We have implemented the system using Java, and Apache XSLT engine Xalan. To support remote data and transformation functions, we had to extend the XSLT specification and the Xalan package.

Introduction

We are entering the second phase of the World Wide Web revolution where the target for information is not a human, but a machine. In the first phase, a digital document was represented using HTML, which is rendered for display by browsers for human consumption. It was soon realized that HTML representation of a digital document has limitations. In particular, it makes the document unsuitable for machine processing, which is essential for building a distributed information infrastructure that can be efficiently searched and managed. The World Wide Web consortium has developed an Extensible Markup Language (XML) to support the building of better information management infrastructures. XML allows a community to describe its own grammar that meets its needs more efficiently. For example, it is now possible for a community to separate the structure of the document from its presentation. One can define a set of tags to represent the abstract structure of the document, which makes it suitable for machine processing.

The scientific computing community, also realizing the benefits of XML, has designed markup languages to represent scientific data. There are several initiatives focusing on this issue, such as the Extensible Scientific Interchange Language (XSIL) (XSIL, 2001), and the eXtensible Data Format (XDF) (XDF, 2001). We hope that finally the community will agree on one language for the scientific data representation. We believe that this language will have two components: a core component describing the structure of the scientific data and the second, discipline specific component, may contain metadata describing the circumstances of the data collection and other information for understanding the data details.

A workshop on Interfaces to Scientific Data Archives organized by California Institute of Technology made a strong case for an XML based scientific data management infrastructure (Williams, 1998). In this

paper, we propose a *X*ML based scientific *d*ata *m*anagement *f*acility (XDMF). The project is motivated by the fact that even though a large amount of scientific data is being generated, both experimentally and programmatically, relatively little is being shared among the scientists because of lack of standards and infrastructure support for discovering and transforming the data. The proposed XDMF will make the process of discovering data along with the relevant transformations required for sharing such data, easier and more efficient. In particular, the focus is to automate this process and make it location independent such that the user, the data and the transformation code may be in distributed locations. Consider the situation in which a scientist wants to use some specific kind of data, for example, wind tunnel data, in the course of a simulation. The user visits the XDMF hosted, say in Virginia, and executes a search using some specific metadata fields. He is presented with a list of registered data satisfying his query. He selects one of the data sets from this list after examining the detailed description. The selected data is available from a site located, say in California (Note that the XDMF only keeps the XML document describing the data and not the data set itself). However, in many cases the data will be in a format not directly useful to the user and it would have to be transformed into another format before it can be utilized. The user can then search the XDMF for a list of applicable transformation functions. The user selects a transformation function located, say in Seattle. The XDMF retrieves the data from California, retrieves the transformation function from Seattle, applies the transformation and sends the transformed data to the user (we are assuming that the data and transformation functions are accessible through HTTP). In a more general scenario, the data would be required only at the time that the code is to be executed as a part of a larger application. In such situations, the proposed XDMF can be integrated into a larger framework and can facilitate the downloading and transformation of the data at runtime.

We have built a prototype of the XDMF that can work on different platforms. We have implemented the system using Java, and Apache XSLT engine, Xalan. To support remote data and transformation functions, we had to extend the Extensible Style Language for Transformation (XSLT) specification and the Xalan package. For our initial prototype, we have used XSIL for representing the scientific data. Note that by doing this we are not endorsing any one initiative. Our objective is to demonstrate the benefits of an XML based data management facility. In fact, we also show that the current scientific data markup languages will need to be extended to build the proposed facility.

The rest of the paper is organized as follows. In the next section we provide some background on XSIL, a XML based scientific data interchange language and XSLT, an XML transformation language. Third section presents an overview and architecture of the proposed facility while the prototype section provides a brief description of the current prototype.

Background

Extensible Scientific Interchange Language (XSIL)

The Extensible Scientific Interchange Language (XSIL) (XSIL, 2001) has been developed by the Center for Advanced Computing Research, Caltech to represent the basic syntactic structure for scientific data such as *Table*, *Array*, and *Stream* in XML. The *Table* is similar to a relational table that contains an unordered set of records, each of the same format; the *Array* is collection of numbers of some other primitive data type; and the *Stream* element provides a link to external and encoded data through files and URL's. Two sample XSIL documents, one representing small size local (in-line) data and the other

```
<?xml version="1.0"?>
<XSIL>
    <Array Name="Coordinates" Type="float">
<Dim>4</Dim>
    <Dim>2</Dim>
    <Stream Encoding="Text" Type="Local"
    Delimiter=", ">1, 0, 1, 1, 0, 1, -1,1
</Stream>
</Array>
</XSIL>
```

```
<?xml version="1.0"?>
<XSIL>
    <Array Name="Coordinates" Type="float">
<Dim>4</Dim>
    <Dim>2</Dim>
    <Stream Type="Remote" Delimiter=", ">
    data.dat</Stream>
</Stream>
</Array>
</XSIL>
```

Figure 1: Sample XSIL documents with local data (left) and remote data (right)

representing remote data, are shown on the left and right side of Figure 1 respectively.

Transformations

The case of transforming an XML document from one form into another is key to the XML usefulness. The transformations are typically necessitated when we move XML documents between two disparate organizations. In such a case, an XML document in one organization exists in a form different from the one in the other organization. This could be because the two organizations are using different languages to markup their data. For this purpose, the World Wide Consortium has introduced Extensible Style Language for Transformation (XSLT). One uses XSLT to write stylesheets, which essentially represent a set of instructions for transforming one XML document type to another. Note that you need an XSLT engine to process these instructions. An example of XSLT engine that is in public domain is Apache Xalan (http://www.apache.org). The XSLT specification also supports transformations like sorting of document elements, summing and averaging numbers, etc.

XDMF

Overview

In this project we have focused on *XDMF*, an XML based scientific data management facility for discovering and transforming data sets stored in distributed locations. Figure 2 gives an overview of the functionality of the XDMF. The XDMF interacts with three entities: the data generator, the transformation

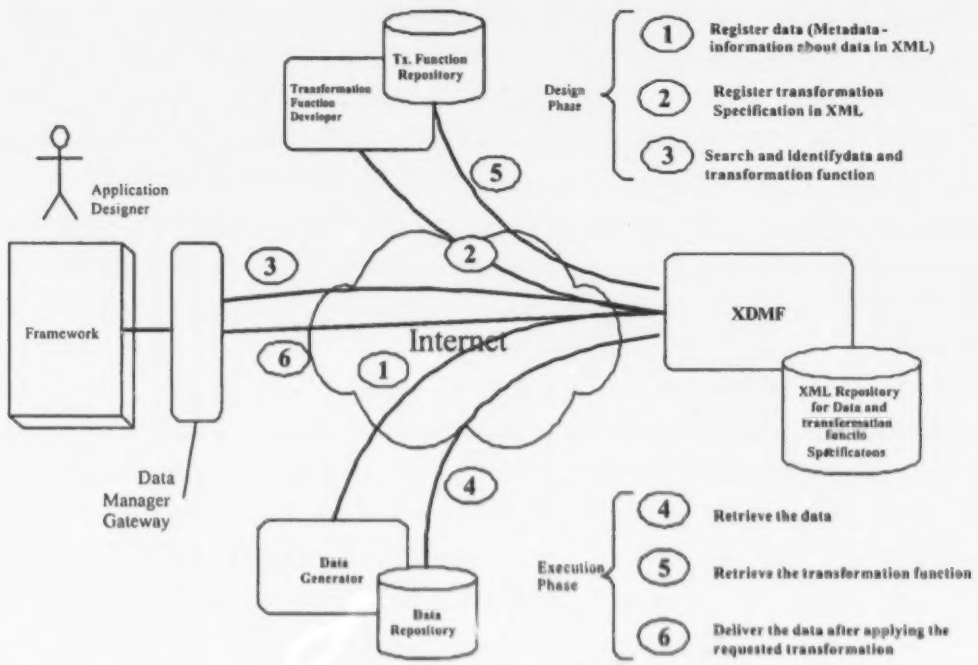

Figure 2: Overview of XDMF

function developer, and a distributed computing framework. The data generator is responsible for registering the scientific data that is to be shared with other researchers. For this he uploads the XSIL file describing the structure of the data along with other metadata providing semantic information about the

data. For example, the metadata could contain information about the conditions and constraints under which the data was generated. The transformation function developer registers the transformation function by uploading the XSLT specification along with necessary metadata that describes the type of transformation, the function support and the constraints under which the transformation is applicable. We are basing our approach for transforming scientific data on the XSLT engine. As the required scientific data transformation could be complex, for example converting a node-centered unstructured grid data in a CFD simulation to an edge-centered format, it is not possible to describe these transformations in the XSLT specification file. In such situations we will use the facility provided by the XSLT specification for referencing external transformation functions. Given that in most cases we will have to use external transformation functions, the question arises: why use the XSLT specification at all? The reasons for using XSLT specification are: (1) the input data specification is in XML and the transformed data is also specified in XML thus necessitating the use of a XSLT engine, (2) development cost is low as the XSLT engine, which is a standard module freely available in public domain, provides support for all the other required work like downloading the transformation function and the scientific data from remote sites, applying the transformation function on the downloaded data, and storing the transformed data and its XML specification.

We now illustrate the information flow by considering an application designer, working with a framework, who is in need of scientific data for his application. During the design phase of his application, he visits the XDMF and identifies a data set registered in the XDMF. Along with the data set, he also chooses an appropriate transformation function in the form of an XSLT specification. During the execution phase, the data management gateway requests the transformed data from the XDMF. The XDMF in turn, downloads the data and the transformation functions from remote locations, applies the transformation and returns the XML file describing the transformed data. The gateway software processes the XML file, retrieves the transformed data and supplies it to the application.

Architecture

The architecture of the XDMF, as shown in Figure 3, consists of (1) a digital library that holds the scientific data specification, transformation function specification along with other metadata, (2) data transformation component based on Xalan XSLT engine that retrieves the data and the transformation function from remote sites and applies the transformation, and (3) publication, search, and transformation request handlers. All interactions with the XDMF are based on HTTP. The data generator interacts with the XDMF publication handler to publish the scientific data specification in XSIL along with other relevant other metadata about the data. Similarly, the transformation specification developer interacts with the publication handler to publish the transformation specification and its metadata. The application designer interacts with the search handler to discover and identify the scientific data and the transformation function in the digital library. The framework gateway initiates retrieval request for the transformed data to the transformation handler, which in turn interacts with the data transformation component.

The Digital Library architecture is based on the Java-based search service that was developed for Joint Training, Analysis and Simulation Center (JTASC) (Maly, 2000). The benefit of this architecture is that it is platform independent, and it can work with any Web server as it is based on Java servlets. Moreover, the changes required to work with different databases are minimal. Our current implementation supports two relational databases, one in the commercial domain (Oracle), and the other in public domain (MYSQL). The architecture employs a three-level caching scheme to improve performance (Maly, 2000).

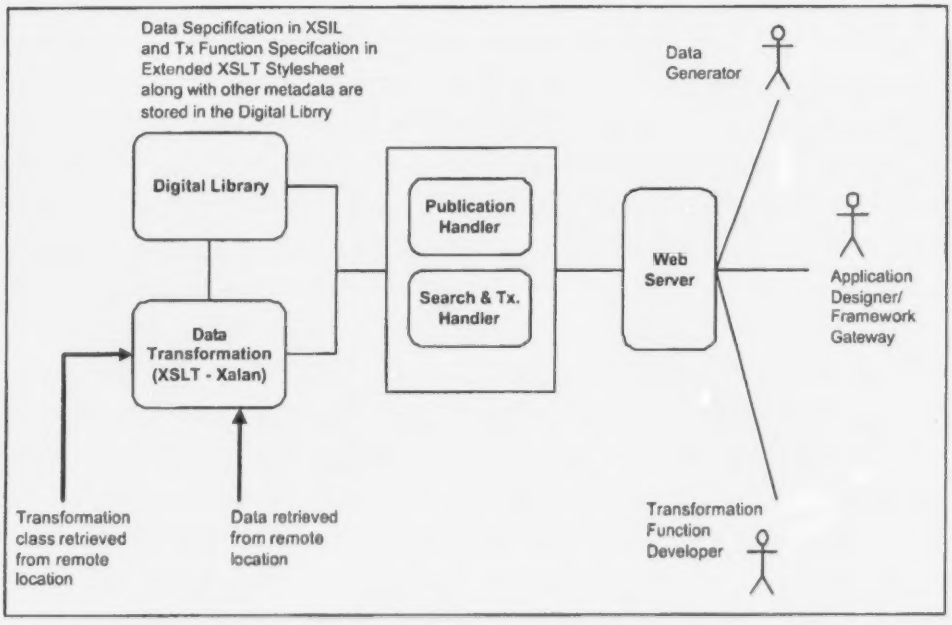
Data Sepcifcation in XSIL and Tx Function Specifcation in Extended XSLT Stylesheet along with other metadata are stored in the Digital Libry
Data Generator
Digital Library
Publication Handler
Search & Tx. Handler
Web Server
Application Designer/ Framework Gateway
Data Transformation (XSLT - Xalan)
Transformation class retrieved from remote location
Data retrieved from remote location
Transformation Function Developer

Figure 3: Architecture of XDMF

Extending XSLT Specification and XALAN

One major problem faced when using XSLT is its limited functionality, especially in performing complex scientific data transformations. The XSLT specification supports constructs for simple operations, such as, sorting and summation, only. However, scientific data transformations are in general much more complex. To address this issue, we have used the XSLT extension support to define new functions that include any scientific transformation logic and to associate them with Java classes. These functions can then be called in a XSLT specification. For this we have to make the following modifications in the XSLT specifications as shown in Figure 4. First, we have to declare an extra namespace for the extension along with an *extension-element-prefix* (lines 4-5, Figure 4). Second, we declare the new function, *polar3* here, and associate it with a remote Java class (lines 6-8, Figure 4). Lastly, we call the extension function, again *polar3*, in the appropriate transformation rule of the XSLT specification (line 14, Figure 4).

The Xalan package does not provide support for a remote Java class, e.g., specified via a URL, which has been associated with the external functions. As described above, access to remote transformations is central to the design of the facility (see Figure 2). To provide this support, we had to extend the Xalan-Java processor to handle the extension function calls specified via a URL by modifying the *ExtensionFunctionHandler.java* in Xalan package org.apache.xalan.xpath.

Prototype

We have implemented a standalone prototype that has the core functionality of the data transformation and digital library support. The current prototype allows users to select a scientific data specification along with the transformation to be applied. Once selected, the XMDF retrieves the scientific data from a remote location, say from www.icase.edu, retrieves the transformation function from, say www.cs.odu.edu, and applies the transformation, delivering the transformed data to the user over the Web. We have also implemented a Web based publication tool, which allows (a) the data generator to upload the XSIL specification of the data along with other metadata into the digital repository, and (b) the transformation function developer to upload the transformation specification along with necessary metadata into the digital repository.

```
<?xml version="1.0"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
    xmlns:axslt="http://xml.apache.org/xslt"
    xmlns:myxslt=http://www.cs.odu.edu/~zubair/demo/RemoteXSLTExtensions
                extension-element-prefixes="myxslt" version="1.0">
 <axslt:component prefix="myxslt" functions="polar3">
 <axslt:script lang="javaclass" src="http://www.cs.odu.edu/~zubair/demo/RemoteXSLTExtensions.class"/>
 </axslt:component>
        ...
 <xsl:template match="Stream">
  <Stream>
        ...
   <xsl:variable name="stream" select="."/>
   <xsl:value-of select="myxslt:polar3(string(@Delimiter), string($stream))"/>
  </Stream>
 </xsl:template>
</xsl:stylesheet>
```

Figure 4: Modified XSLT specification for transforming data using an external function

Conclusion and Future Work

In this paper we have proposed a XML based data management facility. The proposed XDMF provides support for: (a) registration of XML documents describing scientific data, (b) registration of XML documents describing transformations functions, (c) association of a scientific data set with the available transformation functions, (d) searching and browsing of scientific data based on specific metadata fields, (e) transformation of data once the user has identified the data and the transformation, (f) remote data and remote transformation functions. The proposed XDMF is easy and efficient to build as it is based on XML standards, thereby allowing reuse of publicly available tools such as parsers, and transformation engines. In future, we plan to develop APIs for the XDMF to allow framework developers to write their own data manager gateway software for integration with XDMF. We plan to work with other researchers in standardizing a XML language for specifying transformation function and other discipline specific component of the scientific data.

Acknowledgments

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Limitations of Course Delivery by Streaming Media

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Abstract: Faculty in the department of Technology and Cognition at the University of North Texas have identified and implemented several course delivery models using streaming media. These models were developed to provide additional delivery systems up and above two-way audio and video, text based websites, and various audio format methods. While streaming media has many implementations, it also presents several limitations to its development and use as a course delivery tool.

In the Department of Technology and Cognition at the University of North Texas, new technologies are being used and tested to deliver class instruction across the Internet as well as more traditional approaches such as text-based websites, audio formats and two-way audio and video. Using streaming media formats for the delivery of course content was appealing to the "high tech" nature of the faculty. Several useful models of course delivery have been described and tested by various faculty members. But, there are inherent limitations to both the streaming media format and using the Internet as a delivery medium. This paper briefly describes five methods for delivering course content via streaming media and discuss some of the major limitations of that delivery method.

Course Delivery Models Using Streaming Media

Streaming Audio

Two graduate level courses have been taught using streaming audio. The instructor lectures to an on-campus section of a course and streams the audio live. Students can listen to the lecture in real time. Viewing web pages as directed enhances the audio portion. This method of instruction requires a microphone, computer with sound card and encoding software. Each lecture is also archived on a server so that students can review it at a later date.

Live Streaming Audio and Video

This approach uses streaming audio and video to deliver instruction in real time via the Internet. Students access a website and view the live broadcast. Basically, the course content is captured using a video camera and microphone, digitized, converted to streaming media, transferred to a streaming media server and delivered to the end user. There is a very brief lag, measured in seconds, between the time the content is actually created and when the user finally receives it. This approach is the most elaborate implementation from a hardware and software perspective. Typically, the live course content is also archived for later use by students

Archive Streaming Media

Faculty members have found that recording course content (audio, video or audio and video) and converting to streaming media for future use is a viable approach to distributed learning. This technique allows for content editing. As is often the case, the first several minutes of a course are devoted to local business, conversation, or other mundane topics. There is little or no benefit to this information for a student not attending the on-campus class. In essence, postproduction editing and archiving creates an efficient module.

Archive Streaming Media with Graphics

One of the advantages of the Real Networks software is the ability to synchronize graphics with the audio or video stream. This technique requires post-production work in order to create and synchronize the graphic elements with the streaming content. This technique is somewhat time consuming but the effort results in an efficient delivery of the content. Again, editing allows for the removal of any activity that is not directly related to the content of the lecture. Real Networks refers to this technique as SMIL Technology. Graphics are synchronized

with the streaming media using time. For instance, simple code is used to instruct the software to show a graphic so many minutes and seconds into the file.

Streaming Audio with 3rd Party Software

Several faculty members have found Screen Watch by Optx (www.Optx.com) to be a unique tool for the delivery of instruction. Screen Watch is a screen capture program similar to Lotus Screen Cam. The Optx product has great advantage because of the large amount of compression applied to the capture resulting in files that easily stream over the Internet. Procedurally, the user narrates his/her on screen activity. The audio portion is recorded and the screen movements, mouse movements, etc. are synchronized to the audio track. This is an ideal platform for teaching computer related topics, how-to's etc. Similar to Real media, this software requires the user to download a browser plug-in in order to view the presentation.

Limitations of Streaming Media

As can be seen from above, we have extensively used streaming media in various implementations as alternatives to traditional on-campus instruction. Although many benefits can be drawn from the use of these technologies, many limitations also need to be taken into account when planning any future implementation of similar courses. The following are some of the limitations we have encountered.

Bandwidth Issues

While offering courseware via the Internet is the biggest advantage of streaming media (whether live or archived), the Internet itself is the biggest disadvantage. Graduate courses in the department are offered in the evenings during peak Internet traffic times. Streaming media requires a large (but not outrageous) amount of bandwidth. Problems have been reported at both ends of the distribution. Students report that streaming media continually pauses and buffers during peak Internet usage times. As a result, an archived file that should play smoothly for perhaps 45 minutes may take over an hour to stream. Another problem also exists at the origination end. In our case, the bandwidth of our connectivity at the university is "maxed out" except between 2 am and 6 am. This builds in a delay before the signal leaves the facility. The magnitude of this phenomenon is great – we have the equivalent of seven T-1's running at full capacity.

Time Issues

It is a recognized fact that preparing a course for distance delivery requires additional time for design, development and implementation. High-tech implementations such as streaming media require additional time associated with video and audio media. Any post-production editing adds additional time to the development process. Although the benefit of using video for instruction is obvious, the creation of these can be overwhelming. A four minute video can take up to 4 hours of production time, between the time of the shooting up until the time the video is on the server ready to be viewed.

Storage Issues

Videos require enormous amounts of file space. Different factors affect the size of these files, among others: the video window size, the bandwidth of the encoded video, the amount of compression applied due to the nature of the motion within the video itself, other bandwidth allocated for graphic materials, etc. The production system will require enough storage space to handle the video at different stages of the process. Video first needs to be captured and digitized. Subsequently, the video is encoded using the Real Producer software The amount of megabytes needed may vary depending on the number of connection options selected for the delivery, the screen size, etc. So for example, a 2-minute video in .avi format, to be displayed on a 320x240 window will take up 160 MB of space. During the compression process delivery options of 56 Kbp and single DSL connection are also added. These rates may vary depending on connection rates more commonly available to the students. The .avi file now compressed into an .rm will take up a total space of 1.4 MB. Although the final numbers are much smaller the hardware required needs to be able to handle and store the files at all stages of the process.

Conclusions

Although streaming media provides a variety of video and audio-based methods to deliver instruction, there are also many limitations. Successful course implementation using streaming media requires normal planning and development time but also requires additional levels of technical expertise. Although these technologies give the "virtual" classroom a futuristic aura and a state of the art appeal, it is these same technologies the ones posing the challenges that can make it difficult for faculty to develop and students to use.

Infusing Technology in Our Teacher Education Courses

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Abstract: Students interested in the technology aspects of being a classroom teacher have several course options available in the College of Education at the University of North Texas. There is an assumption that most students will bring some level of computer proficiency with them into their coursework. For those whose skills are weak an introductory course on computer literacy and basic computer applications is suggested. This course can be taken on-line in an independent study mode supported via technology such as email, on-line testing, and discussion forums. A traditional, on-campus classroom section of this course is also offered for those that require more structure and guided instruction. Outcomes of this course, either distance delivered or the on-campus offering, meet the necessary prerequisites for other courses in the technology sequence. In addition, this course provides many students their first exposure to distance delivered instruction and technology-based instruction.

Instructional Technology

In our Introduction to Instructional Technology classes future teachers are being introduced to the effective use of old and new technologies to deliver their lessons. Within the first weeks of the semester, students are introduced not only to different learning theories and teaching models but also to hands-on modules integrated with each new chapter. These hands-on modules demonstrate real world technology applications and provide the connection to appropriate uses and inclusion of both old and new technologies of instruction. As soon as learning theory is reviewed, the classes concentrate on several book and multimedia modules that overview the system's process (instructional design, etc)... then progress to non-projected and projected media elements that are demonstrated and then reinforced via subsequent lab experiences (i.e. a chance to learn how to dry mount, rubber cement, and create non-computer transparencies...) for a taste of the old which is still in use today. Immediately, students are also taught how to create and enhance transparencies with the use of a flat bed scanner, computer, drawing software and a color printer. In order to create these transparencies students exchange the old cardboard frames for the word processor or the power point program, and the scissors and glue for the new cut and paste features found in both programs.

Students are taught the basic uses of both software packages and the features that could help them enhance a presentation and a handout. The scanner and features of graphics software are also demonstrated to teach students how to include pictures when the clipart library found in the software is not enough. The use of a digital photo camera provides the students skills at obtaining additional illustrations. In subsequent modules students are given a chance to understand and use digital video cameras and create a "how to" team video, use the Internet for specialized searches, evaluate educational software and web sites given a criteria, create a web page, attend and participate in a hands-on videoconferencing demonstration, learn about filtering software, virus scanning, web based courses and much more. Although each skill is addressed at only an introductory level, students' awareness of all these tools and teaching methods gives the future teachers enough guidance on the use of technology inclusion methodology, thereby enhancing and enriching their skills as a teacher. The hands-on approach seeks to prove that, although complex in

their inner workings, the tools themselves are easy to use and have a very short learning curve. Familiarity should result in a relaxed understanding and eventual use of technology mated with creative ideas.

Other Technology Courses

Also in the sequence of preservice technology courses is Computers in Education. This course stresses the use of technology in the classroom with an eye toward integration of technology into the curriculum. Students in the course increase their knowledge of technology and its impact on teaching and learning. In addition, topics such as development of student portfolios, evaluating software, creative activities using the Internet by students are investigated.

One of the goals of the Special Education Program is to develop distance education technology that enhances and supports the delivery of a quality Educational Diagnostician Program. The main features of the distance education program include:

Didactic classes delivered through an electronic, microwave-based, interactive, closed circuit two-way television system. The program is currently serving five sites, with the option of adding more as the program expands. Broadcasts typically originate from the UNT System Center, but most professors broadcast from each site at least once during the semester. There is a support person at each site to address technology needs. During broadcasts, the instructors may lecture, conduct a class discussion, show a video, or present information on an overhead. Faculty present lectures using PowerPoint slides. Students give presentations, discuss and ask questions, and work in small groups. There are two large television screens at each site. The instructor and students are viewed live on television screens and that image is transmitted to all sites. The camera is voice activated and projects the image of the person speaking at the time. Students and instructors interact in much the same way as they do in on-site classes.

A program Web site provides general information about the program, application forms, and faculty to contact for additional information. In addition, each faculty member maintains his/her own web page for courses offered. Extended syllabus, assignments, class notes, announcements, and tests are transmitted through the Web site. In addition, students' work/projects may be posted in certain classes for other students' viewing and learning. Potential students can open the Web site and view information about the program prior to enrolling.

Practicum courses are supported through EnVision, a two-way audio/video desktop conferencing software developed by Sorenson, Inc. EnVision is available on the main campus and in each of the centers of the university. Students in their final year of study can check out an EnVision software system to use on their school computer. Faculty can observe students during assessment with standardized tests through EnVision and provide immediate feedback to the student. The chat function on EnVision is used to coach the student during the assessment process, if needed. The protocol currently used for assessment supervision provides information directly to the student through the document share function. Students can also discuss specific projects in a timely manner.

The array of technologies assembled by the program has provided an effective platform for distance education for special educators. Technology is an important component of the Educational Diagnostician Program. Needs of the program, students and instructors dictate technology used. Technology serves as a tool to make a highly successful program convenient for commuter students while enhancing learning opportunities.

Using Two-way Audio Video Desktop Technology to Support Educators Seeking Educational Diagnostician Certification in a Distance Education Program

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Abstract

EnVision by Sorenson, a high-quality Internet video conferencing tool, is used to support teachers seeking an Educational Diagnostician certificate at the University of North Texas. This desktop conferencing system offers face-to-face communication and provides opportunities for advising students at a distance and for assessment processes. Parents, teachers and students in a day treatment center are interviewed using the EnVision system. This technology provides easy access to individuals who in the past were not able to complete certification due to distance constraints.

A high-quality Internet video conferencing system is used at the University of North Texas to provide distance education for teachers seeking an Educational Diagnostician certificate. This field-based program is designed to increase the number of certified Educational Diagnosticians available to work with students with disabilities in the public schools and/or private agencies. Educational Diagnosticians play a key role in the identification of students eligible for special education services, as well as providing on-going support for educators, parents and students in designing appropriate assessment strategies.

There is a need to deliver the same high quality of instruction and supervision previously only available on the main campus of the university. To address that need, didactic courses are redesigned and delivered using two-way interactive video technology. Web pages contain information for students previously presented in class as handouts. All course overheads are available as Power Point presentations and posted on the web. E-mail and chat groups support student interactions regarding assignments, questions, and other topics for discussion. The field-based component is supported with the Sorenson EnVision, a high-quality low bandwidth solution for desktop video conferencing and collaboration.

Establishing a quality distance education program for Educational Diagnosticians requires frequent and explicit communication between professors and adult students. While the use of e-mail for communication has increased greatly in the past few years, some students express an interest in face-to-face contact with faculty members while enrolled in a distance education class. The EnVision two-way audio video technology has helped address that issue. The faculty member can be available from his/her office location, and does not have to rely on a university sponsored interactive video system to provide the face-to-face contact or travel directly to the site.

EnVision is a high-quality reliable video conferencing software that is capable of running on a Pentium 90 MHZ or faster processor. The two-way conferencing technology digitally compressed voice and video information requires a low-bandwidth connection and is transmitted over ordinary phone lines or the Internet. Other features include simultaneous collaboration on any document in a document-share option, a chat function for real time communication, and a white board.

The EnVision kit includes a NTSC camera, a PCI card with audio and video processors, H.323 desktop video conferencing software CD, audio headset, microphone and earphone, stand-alone microphone, jumper cables,

and all necessary installation documentation. EnVision kits are checked out to students in the program at the beginning of the academic year. Kits are returned at the end of the academic year.

The desktop conferencing system provides the technology to support collaboration in an efficient and timely manner. It is easy to use, requiring the student to simply sign on by opening the software. A Call Center function provides a list of individuals ready to receive a call. A click connects the two individuals. The Chat function provides real time communication for typing messages. Students use this function to provide information prior to and/or during the assessment process. The Chat function is instant messages, making it preferable to e-mail in some situations. The Document-share function provides students with a format to display the assessment protocol or information taken in an observation, interview or questionnaire. The White-board function provides for drawing and posting information.

Advising students, and often students' peers that are interested in university work, also can take place over the EnVision system. This face-to-face contact and the demonstration of technology is both exciting and available to current and potential students. Faculty use the two-way technology as a positive recruiting tool, as well as a tool for advising current students in a prompt, personal format.

The two-way audio video connection has also provided an opportunity for supervision at a distance. One part of field experiences for the Educational Diagnostician distance education program centers on assessment procedures. While a critical component of the program, supervising the assessment process at a distance presents unique challenges. Assessment is the process of collecting data for the purpose of decision making (Salvia & Ysseldyke, 1998). Aligning the assessment procedures to provide continuous monitoring of individual progress is required for teachers to meet the definition for special education as *specialized instruction.* In order to provide students with disabilities an appropriate education, teachers need information about student progress in a timely, systematic fashion that can be used to make instructional decisions on a per student basis. Educational Diagnosticians provide expertise in the area of assessment to individuals working with students.

Evaluation measures are encouraged for use by classroom teachers to gain information about students' academic performance that are both formative and summative in design. Formative evaluation information is collected continuously throughout the school year, while summative evaluation information is generally collected at the end of the school term (Dyck, Pemberton, Woods, & Sundbye, 1999). Typically, both measures provide a telescope view of a student's performance in relation to instruction that indicates either intra or interindividual progress.

Curriculum-based assessment (CBA) involves the measurement of the level of a student in terms of the content of the student's curriculum. As more students are receiving all or part of their education in the general education classroom, CBA procedures have increased in use (Taylor, 2000). According to Taylor, teachers should use CBAs to aid in the determination and evaluation of objectives and teaching strategies. Various models of CBA are presented in the professional literature, with particular attention given to measures of student mastery of objectives derived from classroom performance and/or measures that teachers can use to alter or modify instructional programs based on student progress.

Students in the Educational Diagnostician program master the competencies for norm-referenced assessments, which can provide information on an individual's performance compared with the performance of many peers. These assessments provide information ranging from academic achievement to intelligence scores, depending upon the test selected. There is a need for students to master the correct procedures required for various norm-reference assessments. The EnVision software is one way for the professor to observe the testing situation at a distance. The chat function and document share function on the EnVision software are both available as a vehicle to provide feedback that is not interruptive of the assessment process.

Parents, teachers, and students in a day treatment center are interviewed over the EnVision system as a part of the process for conducting a Functional Behavior Assessment. A Functional Behavior Assessment to develop a positive behavior plan is now required by the Individual with Disabilities Act of 1997 for students with behavior problems that impede his or her learning or the learning of others. The goal of the functional assessment is to provide information to use in the redesign of environments and selection of new skills to be taught. Part of this assessment is gathering information from interviews, questionnaires, and direct observation. Interview opportunities have been expanded through the use of EnVision.

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